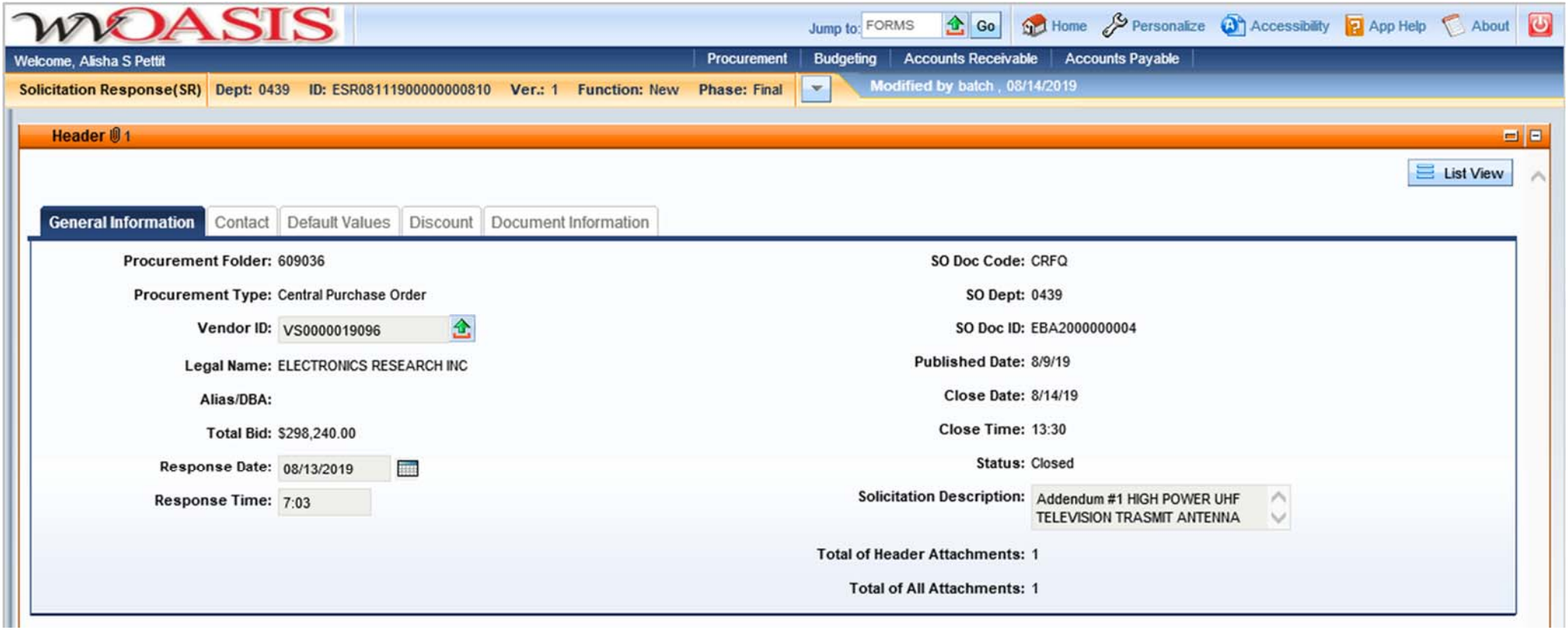
The following documentation is an electronically-submitted vendor response to an advertised solicitation from the *West Virginia Purchasing Bulletin* within the Vendor Self-Service portal at ***wvOASIS.gov***. As part of the State of West Virginia's procurement process, and to maintain the transparency of the bid-opening process, this documentation submitted online is publicly posted by the West Virginia Purchasing Division at ***WVPurchasing.gov*** with any other vendor responses to this solicitation submitted to the Purchasing Division in hard copy format.


WVOASIS
Jump to: FORMS Go
Home
Personalize
Accessibility
App Help
About
Welcome, Alisha S Pettit
Procurement
Budgeting
Accounts Receivable
Accounts Payable
Solicitation Response(SR) Dept: 0439 ID: ESR08111900000000810 Ver.: 1 Function: New Phase: Final
Modified by batch , 08/14/2019
Header 1
List View
General Information
Contact
Default Values
Discount
Document Information
Procurement Folder: 609036
Procurement Type: Central Purchase Order
Vendor ID: VS0000019096
Legal Name: ELECTRONICS RESEARCH INC
Alias/DBA:
Total Bid: $298,240.00
Response Date: 08/13/2019
Response Time: 7:03
SO Doc Code: CRFQ
SO Dept: 0439
SO Doc ID: EBA2000000004
Published Date: 8/9/19
Close Date: 8/14/19
Close Time: 13:30
Status: Closed
Solicitation Description: Addendum #1 HIGH POWER UHF TELEVISION TRASMIT ANTENNA
Total of Header Attachments: 1
Total of All Attachments: 1

Purchasing Division
2019 Washington Street East
Post Office Box 50130
Charleston, WV 25305-0130

State of West Virginia
Solicitation Response

Proc Folder : 609036

Solicitation Description : Addendum #1 HIGH POWER UHF TELEVISION TRASMIT ANTENNA

Proc Type : Central Purchase Order

Date issued	Solicitation Closes	Solicitation Response	Version
	2019-08-14 13:30:00	SR 0439 ESR08111900000000810	1

VENDOR

VS0000019096

ELECTRONICS RESEARCH INC

Solicitation Number: CRFQ 0439 EBA2000000004

Total Bid : $298,240.00 **Response Date:** 2019-08-13 **Response Time:** 07:03:24

Comments:

FOR INFORMATION CONTACT THE BUYER

Stephanie L Gale

(304) 558-8801
stephanie.l.gale@wv.gov

Signature on File **FEIN #** **DATE**

All offers subject to all terms and conditions contained in this solicitation

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Ln Total Or Contract Amount
1	HIGH POWER UHF TV TRANSMIT ANTENNA	1.00000	EA	$298,240.000000	$298,240.00

Comm Code	Manufacturer	Specification	Model #
43221703			

Extended Description : HIGH POWER UHF TV TRANSMIT ANTENNA

Purchasing Divison
2019 Washington Street East
Post Office Box 50130
Charleston, WV 25305-0130

State of West Virginia
Request for Quotation
04 — Audio/Video

Proc Folder: 609036

Doc Description: Addendum #1 HIGH POWER UHF TELEVISION TRASMIT ANTENNA

Proc Type: Central Purchase Order

Date Issued	Solicitation Closes	Solicitation No	Version
2019-08-09	2019-08-14 13:30:00	CRFQ 0439 EBA2000000004	2

BID RECEIVING LOCATION

BID CLERK
DEPARTMENT OF ADMINISTRATION
PURCHASING DIVISION
2019 WASHINGTON ST E
CHARLESTON WV 25305
US

VENDOR

Vendor Name, Address and Telephone Number:

Electronics Research, Inc.
7777 Gardner Road
Chandler, IN 47610
+1 (812) 925-6000
Bill Harland, Vice President of Marketing
bharland@eriinc.com

FOR INFORMATION CONTACT THE BUYER

Stephanie L Gale
(304) 558-8801
stephanie.l.gale@wv.gov

Signature X William C. Harland **FEIN #** 35-1083384 **DATE** August 13, 2019

All offers subject to all terms and conditions contained in this solicitation

ADDITIONAL INFORMATION:

Addendum #1 issued to:

1. Provide responses to technical questions.

End of Addendum #1.

INVOICE TO	SHIP TO
CHIEF FINANCIAL OFFICER	SITE MANAGER
EDUCATIONAL BROADCASTING	EDUCATIONAL BROADCASTING
124 INDUSTRIAL PARK RD	WNPB-TV
	191 SCOTT AVE
BEAVER WV 25813	MORGANTOWN WV 26505
US	US

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Total Price
1	HIGH POWER UHF TV TRANSMIT ANTENNA	1.00000	EA	$298,240.00	$298,240.00

Comm Code	Manufacturer	Specification	Model #
43221703	Electronics Research, Inc.	20190810-396	ATW21H4-ETC170-34H

Extended Description :

HIGH POWER UHF TV TRANSMIT ANTENNA

ADDITIONAL TERMS AND CONDITIONS

See attached document(s) for additional Terms and Conditions

INSTRUCTIONS TO VENDORS SUBMITTING BIDS

1. REVIEW DOCUMENTS THOROUGHLY: The attached documents contain a solicitation for bids. Please read these instructions and all documents attached in their entirety. These instructions provide critical information about requirements that if overlooked could lead to disqualification of a Vendor's bid. All bids must be submitted in accordance with the provisions contained in these instructions and the Solicitation. Failure to do so may result in disqualification of Vendor's bid.

2. MANDATORY TERMS: The Solicitation may contain mandatory provisions identified by the use of the words "must," "will," and "shall." Failure to comply with a mandatory term in the Solicitation will result in bid disqualification.

3. PREBID MEETING: The item identified below shall apply to this Solicitation.

☑ A pre-bid meeting will not be held prior to bid opening

☐ A **NON-MANDATORY PRE-BID** meeting will be held at the following place and time:

☐ A **MANDATORY PRE-BID** meeting will be held at the following place and time:

All Vendors submitting a bid must attend the mandatory pre-bid meeting. Failure to attend the mandatory pre-bid meeting shall result in disqualification of the Vendor's bid. No one person attending the pre-bid meeting may represent more than one Vendor.

An attendance sheet provided at the pre-bid meeting shall serve as the official document verifying attendance. The State will not accept any other form of proof or documentation to verify attendance. Any person attending the pre-bid meeting on behalf of a Vendor must list on the attendance sheet his or her name and the name of the Vendor he or she is representing.

Additionally, the person attending the pre-bid meeting should include the Vendor's E-Mail address, phone number, and Fax number on the attendance sheet. It is the Vendor's responsibility to locate the attendance sheet and provide the required information. Failure to complete the attendance sheet as required may result in disqualification of Vendor's bid.

All Vendors should arrive prior to the starting time for the pre-bid. Vendors who arrive after the starting time but prior to the end of the pre-bid will be permitted to sign in, but are charged with knowing all matters discussed at the pre-bid.

Questions submitted at least five business days prior to a scheduled pre-bid will be discussed at the pre-bid meeting if possible. Any discussions or answers to questions at the pre-bid meeting are preliminary in nature and are non-binding. Official and binding answers to questions will be published in a written addendum to the Solicitation prior to bid opening.

4. VENDOR QUESTION DEADLINE: Vendors may submit questions relating to this Solicitation to the Purchasing Division. Questions must be submitted in writing. All questions must be submitted on or before the date listed below and to the address listed below in order to be considered. A written response will be published in a Solicitation addendum if a response is possible and appropriate. Non-written discussions, conversations, or questions and answers regarding this Solicitation are preliminary in nature and are nonbinding.

Submitted e-mails should have solicitation number in the subject line.

Question Submission Deadline: August 6, 2019 @ 8:00am

Submit Questions to: Stephanie Gale
2019 Washington Street, East
Charleston, WV 25305
Fax: (304) 558-4115 (Vendors should not use this fax number for bid submission)
Email: Stephanie.L.Gale@wv.gov

5. VERBAL COMMUNICATION: Any verbal communication between the Vendor and any State personnel is not binding, including verbal communication at the mandatory pre-bid conference. Only information issued in writing and added to the Solicitation by an official written addendum by the Purchasing Division is binding.

6. BID SUBMISSION: All bids must be submitted electronically through wvOASIS or signed and delivered by the Vendor to the Purchasing Division at the address listed below on or before the date and time of the bid opening. Any bid received by the Purchasing Division staff is considered to be in the possession of the Purchasing Division and will not be returned for any reason. The Purchasing Division will not accept bids, modification of bids, or addendum acknowledgment forms via e-mail. Acceptable delivery methods include electronic submission via wvOASIS, hand delivery, delivery by courier, or facsimile.

The bid delivery address is:
Department of Administration, Purchasing Division
2019 Washington Street East
Charleston, WV 25305-0130

A bid that is not submitted electronically through wvOASIS should contain the information listed below on the face of the envelope or the bid may be rejected by the Purchasing Division.:

SEALED BID:
BUYER:
SOLICITATION NO.:
BID OPENING DATE:
BID OPENING TIME:
FAX NUMBER:

The Purchasing Division may prohibit the submission of bids electronically through wvOASIS at its sole discretion. Such a prohibition will be contained and communicated in the wvOASIS system resulting in the Vendor's inability to submit bids through wvOASIS. Submission of a response to an Expression or Interest or Request for Proposal is not permitted in wvOASIS.

For Request For Proposal ("RFP") Responses Only: In the event that Vendor is responding to a request for proposal, the Vendor shall submit one original technical and one original cost proposal plus _____convenience copies of each to the Purchasing Division at the address shown above. Additionally, the Vendor should identify the bid type as either a technical or cost proposal on the face of each bid envelope submitted in response to a request for proposal as follows:

BID TYPE: (This only applies to CRFP)
☐ Technical
☐ Cost

7. BID OPENING: Bids submitted in response to this Solicitation will be opened at the location identified below on the date and time listed below. Delivery of a bid after the bid opening date and time will result in bid disqualification. For purposes of this Solicitation, a bid is considered delivered when confirmation of delivery is provided by wvOASIS (in the case of electronic submission) or when the bid is time stamped by the official Purchasing Division time clock (in the case of hand delivery).

Bid Opening Date and Time: August 14, 2019 @ 1:30pm

Bid Opening Location: Department of Administration, Purchasing Division
2019 Washington Street East
Charleston, WV 25305-0130

8. ADDENDUM ACKNOWLEDGEMENT: Changes or revisions to this Solicitation will be made by an official written addendum issued by the Purchasing Division. Vendor should acknowledge receipt of all addenda issued with this Solicitation by completing an Addendum Acknowledgment Form, a copy of which is included herewith. Failure to acknowledge addenda may result in bid disqualification. The addendum acknowledgement should be submitted with the bid to expedite document processing.

9. BID FORMATTING: Vendor should type or electronically enter the information onto its bid to prevent errors in the evaluation. Failure to type or electronically enter the information may result in bid disqualification.

10. ALTERNATE MODEL OR BRAND: Unless the box below is checked, any model, brand, or specification listed in this Solicitation establishes the acceptable level of quality only and is not intended to reflect a preference for, or in any way favor, a particular brand or vendor. Vendors may bid alternates to a listed model or brand provided that the alternate is at least equal to the model or brand and complies with the required specifications. The equality of any alternate being bid shall be determined by the State at its sole discretion. Any Vendor bidding an alternate model or brand should clearly identify the alternate items in its bid and should include manufacturer's specifications, industry literature, and/or any other relevant documentation demonstrating the equality of the alternate items. Failure to provide information for alternate items may be grounds for rejection of a Vendor's bid.

☐ This Solicitation is based upon a standardized commodity established under W. Va. Code § 5A-3-61. Vendors are expected to bid the standardized commodity identified. Failure to bid the standardized commodity will result in your firm's bid being rejected.

11. EXCEPTIONS AND CLARIFICATIONS: The Solicitation contains the specifications that shall form the basis of a contractual agreement. Vendor shall clearly mark any exceptions, clarifications, or other proposed modifications in its bid. Exceptions to, clarifications of, or modifications of a requirement or term and condition of the Solicitation may result in bid disqualification.

12. COMMUNICATION LIMITATIONS: In accordance with West Virginia Code of State Rules §148-1-6.6, communication with the State of West Virginia or any of its employees regarding this Solicitation during the solicitation, bid, evaluation or award periods, except through the Purchasing Division, is strictly prohibited without prior Purchasing Division approval. Purchasing Division approval for such communication is implied for all agency delegated and exempt purchases.

13. REGISTRATION: Prior to Contract award, the apparent successful Vendor must be properly registered with the West Virginia Purchasing Division and must have paid the $125 fee, if applicable.

14. UNIT PRICE: Unit prices shall prevail in cases of a discrepancy in the Vendor's bid.

15. PREFERENCE: Vendor Preference may be requested in purchases of motor vehicles or construction and maintenance equipment and machinery used in highway and other infrastructure projects. Any request for preference must be submitted in writing with the bid, must specifically identify the preference requested with reference to the applicable subsection of West Virginia Code § 5A-3-37, and should include with the bid any information necessary to evaluate and confirm the applicability of the requested preference. A request form to help facilitate the request can be found at:
http://www.state.wv.us/admin/purchase/vrc/Venpref.pdf.

15A. RECIPROCAL PREFERENCE: The State of West Virginia applies a reciprocal preference to all solicitations for commodities and printing in accordance with W. Va. Code § 5A-3-37(b). In effect, non-resident vendors receiving a preference in their home states, will see that same preference granted to West Virginia resident vendors bidding against them in West Virginia. A request form to help facilitate the request can be found at:
http://www.state.wv.us/admin/purchase/vrc/Venpref.pdf.

16. SMALL, WOMEN-OWNED, OR MINORITY-OWNED BUSINESSES: For any solicitations publicly advertised for bid, in accordance with West Virginia Code §5A-3-37(a)(7) and W. Va. CSR § 148-22-9, any non-resident vendor certified as a small, women-owned, or minority-owned business under W. Va. CSR § 148-22-9 shall be provided the same preference made available to any resident vendor. Any non-resident small, women-owned, or minority-owned business must identify itself as such in writing, must submit that writing to the Purchasing Division with its bid, and must be properly certified under W. Va. CSR § 148-22-9 prior to contract award to receive the preferences made available to resident vendors. Preference for a non-resident small, women-owned, or minority owned business shall be applied in accordance with W. Va. CSR § 148-22-9.

17. WAIVER OF MINOR IRREGULARITIES: The Director reserves the right to waive minor irregularities in bids or specifications in accordance with West Virginia Code of State Rules § 148-1-4.6.

18. ELECTRONIC FILE ACCESS RESTRICTIONS: Vendor must ensure that its submission in wvOASIS can be accessed and viewed by the Purchasing Division staff immediately upon bid opening. The Purchasing Division will consider any file that cannot be immediately accessed and viewed at the time of the bid opening (such as, encrypted files, password protected files, or incompatible files) to be blank or incomplete as context requires, and are therefore unacceptable. A vendor will not be permitted to unencrypt files, remove password protections, or resubmit documents after bid opening to make a file viewable if those documents are required with the bid. A Vendor may be required to provide document passwords or remove access restrictions to allow the Purchasing Division to print or electronically save documents provided that those documents are viewable by the Purchasing Division prior to obtaining the password or removing the access restriction.

19. NON-RESPONSIBLE: The Purchasing Division Director reserves the right to reject the bid of any vendor as Non-Responsible in accordance with W. Va. Code of State Rules § 148-1-5.3, when the Director determines that the vendor submitting the bid does not have the capability to fully perform, or lacks the integrity and reliability to assure good-faith performance."

20. ACCEPTANCE/REJECTION: The State may accept or reject any bid in whole, or in part in accordance with W. Va. Code of State Rules § 148-1-4.5. and § 148-1-6.4.b."

21. YOUR SUBMISSION IS A PUBLIC DOCUMENT: Vendor's entire response to the Solicitation and the resulting Contract are public documents. As public documents, they will be disclosed to the public following the bid/proposal opening or award of the contract, as required by the competitive bidding laws of West Virginia Code §§ 5A-3-1 et seq., 5-22-1 et seq., and 5G-1-1 et seq. and the Freedom of Information Act West Virginia Code §§ 29B-1-1 et seq.

DO NOT SUBMIT MATERIAL YOU CONSIDER TO BE CONFIDENTIAL, A TRADE SECRET, OR OTHERWISE NOT SUBJECT TO PUBLIC DISCLOSURE.

Submission of any bid, proposal, or other document to the Purchasing Division constitutes your explicit consent to the subsequent public disclosure of the bid, proposal, or document. The Purchasing Division will disclose any document labeled "confidential," "proprietary," "trade secret," "private," or labeled with any other claim against public disclosure of the documents, to include any "trade secrets" as defined by West Virginia Code § 47-22-1 et seq. All submissions are subject to public disclosure without notice.

22. INTERESTED PARTY DISCLOSURE: West Virginia Code § 6D-1-2 requires that the vendor submit to the Purchasing Division a disclosure of interested parties to the contract for all contracts with an actual or estimated value of at least $1 Million. That disclosure must occur on the form prescribed and approved by the WV Ethics Commission prior to contract award. A copy of that form is included with this solicitation or can be obtained from the WV Ethics Commission. This requirement does not apply to publicly traded companies listed on a national or international stock exchange. A more detailed definition of interested parties can be obtained from the form referenced above.

23. WITH THE BID REQUIREMENTS: In instances where these specifications require documentation or other information with the bid, and a vendor fails to provide it with the bid, the Director of the Purchasing Division reserves the right to request those items after bid opening and prior to contract award pursuant to the authority to waive minor irregularities in bids or specifications under W. Va. CSR § 148-1-4.6. This authority does not apply to instances where state law mandates receipt with the bid.

GENERAL TERMS AND CONDITIONS:

1. CONTRACTUAL AGREEMENT: Issuance of a Award Document signed by the Purchasing Division Director, or his designee, and approved as to form by the Attorney General's office constitutes acceptance of this Contract made by and between the State of West Virginia and the Vendor. Vendor's signature on its bid signifies Vendor's agreement to be bound by and accept the terms and conditions contained in this Contract.

2. DEFINITIONS: As used in this Solicitation/Contract, the following terms shall have the meanings attributed to them below. Additional definitions may be found in the specifications included with this Solicitation/Contract.

2.1. "Agency" or **"Agencies"** means the agency, board, commission, or other entity of the State of West Virginia that is identified on the first page of the Solicitation or any other public entity seeking to procure goods or services under this Contract.

2.2. "Bid" or **"Proposal"** means the vendors submitted response to this solicitation.

2.3. "Contract" means the binding agreement that is entered into between the State and the Vendor to provide the goods or services requested in the Solicitation.

2.4. "Director" means the Director of the West Virginia Department of Administration, Purchasing Division.

2.5. "Purchasing Division" means the West Virginia Department of Administration, Purchasing Division.

2.6. "Award Document" means the document signed by the Agency and the Purchasing Division, and approved as to form by the Attorney General, that identifies the Vendor as the contract holder.

2.7. "Solicitation" means the official notice of an opportunity to supply the State with goods or services that is published by the Purchasing Division.

2.8. "State" means the State of West Virginia and/or any of its agencies, commissions, boards, etc. as context requires.

2.9. "Vendor" or **"Vendors"** means any entity submitting a bid in response to the Solicitation, the entity that has been selected as the lowest responsible bidder, or the entity that has been awarded the Contract as context requires.

3. CONTRACT TERM; RENEWAL; EXTENSION: The term of this Contract shall be determined in accordance with the category that has been identified as applicable to this Contract below:

☐ **Term Contract**

Initial Contract Term: Initial Contract Term: This Contract becomes effective on _____ and extends for a period of _____year(s).

Renewal Term: This Contract may be renewed upon the mutual written consent of the Agency, and the Vendor, with approval of the Purchasing Division and the Attorney General's office (Attorney General approval is as to form only). Any request for renewal should be delivered to the Agency and then submitted to the Purchasing Division thirty (30) days prior to the expiration date of the initial contract term or appropriate renewal term. A Contract renewal shall be in accordance with the terms and conditions of the original contract. Unless otherwise specified below, renewal of this Contract is limited to _____ successive one (1) year periods or multiple renewal periods of less than one year, provided that the multiple renewal periods do not exceed the total number of months available in all renewal years combined. Automatic renewal of this Contract is prohibited. Renewals must be approved by the Vendor, Agency, Purchasing Division and Attorney General's office (Attorney General approval is as to form only)

☐ **Alternate Renewal Term** – This contract may be renewed for _____ successive _____ year periods or shorter periods provided that they do not exceed the total number of months contained in all available renewals. Automatic renewal of this Contract is prohibited. Renewals must be approved by the Vendor, Agency, Purchasing Division and Attorney General's office (Attorney General approval is as to form only)

Delivery Order Limitations: In the event that this contract permits delivery orders, a delivery order may only be issued during the time this Contract is in effect. Any delivery order issued within one year of the expiration of this Contract shall be effective for one year from the date the delivery order is issued. No delivery order may be extended beyond one year after this Contract has expired.

☐ **Fixed Period Contract:** This Contract becomes effective upon Vendor's receipt of the notice to proceed and must be completed within _____days.

☐ **Fixed Period Contract with Renewals:** This Contract becomes effective upon Vendor's receipt of the notice to proceed and part of the Contract more fully described in the attached specifications must be completed within _____ days. Upon completion of the work covered by the preceding sentence, the vendor agrees that maintenance, monitoring, or warranty services will be provided for _____ year(s) thereafter.

☑ **One Time Purchase:** The term of this Contract shall run from the issuance of the Award Document until all of the goods contracted for have been delivered, but in no event will this Contract extend for more than one fiscal year.

☐ **Other:** See attached.

4. NOTICE TO PROCEED: Vendor shall begin performance of this Contract immediately upon receiving notice to proceed unless otherwise instructed by the Agency. Unless otherwise specified, the fully executed Award Document will be considered notice to proceed.

5. QUANTITIES: The quantities required under this Contract shall be determined in accordance with the category that has been identified as applicable to this Contract below.

☐ **Open End Contract:** Quantities listed in this Solicitation are approximations only, based on estimates supplied by the Agency. It is understood and agreed that the Contract shall cover the quantities actually ordered for delivery during the term of the Contract, whether more or less than the quantities shown.

☐ **Service:** The scope of the service to be provided will be more clearly defined in the specifications included herewith.

☐ **Combined Service and Goods:** The scope of the service and deliverable goods to be provided will be more clearly defined in the specifications included herewith.

☑ **One Time Purchase:** This Contract is for the purchase of a set quantity of goods that are identified in the specifications included herewith. Once those items have been delivered, no additional goods may be procured under this Contract without an appropriate change order approved by the Vendor, Agency, Purchasing Division, and Attorney General's office.

6. EMERGENCY PURCHASES: The Purchasing Division Director may authorize the Agency to purchase goods or services in the open market that Vendor would otherwise provide under this Contract if those goods or services are for immediate or expedited delivery in an emergency. Emergencies shall include, but are not limited to, delays in transportation or an unanticipated increase in the volume of work. An emergency purchase in the open market, approved by the Purchasing Division Director, shall not constitute of breach of this Contract and shall not entitle the Vendor to any form of compensation or damages. This provision does not excuse the State from fulfilling its obligations under a One Time Purchase contract.

7. REQUIRED DOCUMENTS: All of the items checked below must be provided to the Purchasing Division by the Vendor as specified below.

☐ **BID BOND (Construction Only):** Pursuant to the requirements contained in W. Va. Code § 5-22-1(c), All Vendors submitting a bid on a construction project shall furnish a valid bid bond in the amount of five percent (5%) of the total amount of the bid protecting the State of West Virginia. The bid bond must be submitted with the bid.

☐ **PERFORMANCE BOND:** The apparent successful Vendor shall provide a performance bond in the amount of 100% of the contract. The performance bond must be received by the Purchasing Division prior to Contract award.

☐ **LABOR/MATERIAL PAYMENT BOND:** The apparent successful Vendor shall provide a labor/material payment bond in the amount of 100% of the Contract value. The labor/material payment bond must be delivered to the Purchasing Division prior to Contract award.

In lieu of the Bid Bond, Performance Bond, and Labor/Material Payment Bond, the Vendor may provide certified checks, cashier's checks, or irrevocable letters of credit. Any certified check, cashier's check, or irrevocable letter of credit provided in lieu of a bond must be of the same amount and delivered on the same schedule as the bond it replaces. A letter of credit submitted in lieu of a performance and labor/material payment bond will only be allowed for projects under $100,000. Personal or business checks are not acceptable. Notwithstanding the foregoing, West Virginia Code § 5-22-1 (d) mandates that a vendor provide a performance and labor/material payment bond for construction projects. Accordingly, substitutions for the performance and labor/material payment bonds for construction projects is not permitted.

☐ **MAINTENANCE BOND:** The apparent successful Vendor shall provide a two (2) year maintenance bond covering the roofing system. The maintenance bond must be issued and delivered to the Purchasing Division prior to Contract award.

☐ **LICENSE(S) / CERTIFICATIONS / PERMITS:** In addition to anything required under the Section of the General Terms and Conditions entitled Licensing, the apparent successful Vendor shall furnish proof of the following licenses, certifications, and/or permits prior to Contract award, in a form acceptable to the Purchasing Division.

☐

☐

☐

☐

The apparent successful Vendor shall also furnish proof of any additional licenses or certifications contained in the specifications prior to Contract award regardless of whether or not that requirement is listed above.

8. INSURANCE: The apparent successful Vendor shall furnish proof of the insurance identified by a checkmark below and must include the State as an additional insured on each policy prior to Contract award. The insurance coverages identified below must be maintained throughout the life of this contract. Thirty (30) days prior to the expiration of the insurance policies, Vendor shall provide the Agency with proof that the insurance mandated herein has been continued. Vendor must also provide Agency with immediate notice of any changes in its insurance policies, including but not limited to, policy cancelation, policy reduction, or change in insurers. The apparent successful Vendor shall also furnish proof of any additional insurance requirements contained in the specifications prior to Contract award regardless of whether or not that insurance requirement is listed in this section.

Vendor must maintain:

☑ **Commercial General Liability Insurance** in at least an amount of: $1,000,000.00 per occurrence.

☐ **Automobile Liability Insurance** in at least an amount of: _____ per occurrence.

☐ **Professional/Malpractice/Errors and Omission Insurance** in at least an amount of: _____ per occurrence.

☐ **Commercial Crime and Third Party Fidelity Insurance** in an amount of: _____ per occurrence.

☐ **Cyber Liability Insurance** in an amount of: _____ per occurrence.

☐ **Builders Risk Insurance** in an amount equal to 100% of the amount of the Contract.

☐ **Pollution Insurance** in an amount of: _____ per occurrence.

☐ **Aircraft Liability** in an amount of: _____ per occurrence.

☑ Additional Insured must be marked

☑ Certificate Holder must be the State of West Virginia

☐

☐

Notwithstanding anything contained in this section to the contrary, the Director of the Purchasing Division reserves the right to waive the requirement that the State be named as an additional insured on one or more of the Vendor's insurance policies if the Director finds that doing so is in the State's best interest.

9. WORKERS' COMPENSATION INSURANCE: The apparent successful Vendor shall comply with laws relating to workers compensation, shall maintain workers' compensation insurance when required, and shall furnish proof of workers' compensation insurance upon request.

10. [Reserved]

11. LIQUIDATED DAMAGES: This clause shall in no way be considered exclusive and shall not limit the State or Agency's right to pursue any other available remedy. Vendor shall pay liquidated damages in the amount specified below or as described in the specifications:

☐ _____ for _____

☐ Liquidated Damages Contained in the Specifications

12. ACCEPTANCE: Vendor's signature on its bid, or on the certification and signature page, constitutes an offer to the State that cannot be unilaterally withdrawn, signifies that the product or service proposed by vendor meets the mandatory requirements contained in the Solicitation for that product or service, unless otherwise indicated, and signifies acceptance of the terms and conditions contained in the Solicitation unless otherwise indicated.

13. PRICING: The pricing set forth herein is firm for the life of the Contract, unless specified elsewhere within this Solicitation/Contract by the State. A Vendor's inclusion of price adjustment provisions in its bid, without an express authorization from the State in the Solicitation to do so, may result in bid disqualification.

14. PAYMENT IN ARREARS: Payment in advance is prohibited under this Contract. Payment may only be made after the delivery and acceptance of goods or services. The Vendor shall submit invoices, in arrears.

15. PAYMENT METHODS: Vendor must accept payment by electronic funds transfer and P-Card. (The State of West Virginia's Purchasing Card program, administered under contract by a banking institution, processes payment for goods and services through state designated credit cards.)

16. TAXES: The Vendor shall pay any applicable sales, use, personal property or any other taxes arising out of this Contract and the transactions contemplated thereby. The State of West Virginia is exempt from federal and state taxes and will not pay or reimburse such taxes.

17. ADDITIONAL FEES: Vendor is not permitted to charge additional fees or assess additional charges that were not either expressly provided for in the solicitation published by the State of West Virginia or included in the unit price or lump sum bid amount that Vendor is required by the solicitation to provide. Including such fees or charges as notes to the solicitation may result in rejection of vendor's bid. Requesting such fees or charges be paid after the contract has been awarded may result in cancellation of the contract.

18. FUNDING: This Contract shall continue for the term stated herein, contingent upon funds being appropriated by the Legislature or otherwise being made available. In the event funds are not appropriated or otherwise made available, this Contract becomes void and of no effect beginning on July 1 of the fiscal year for which funding has not been appropriated or otherwise made available.

19. CANCELLATION: The Purchasing Division Director reserves the right to cancel this Contract immediately upon written notice to the vendor if the materials or workmanship supplied do not conform to the specifications contained in the Contract. The Purchasing Division Director may also cancel any purchase or Contract upon 30 days written notice to the Vendor in accordance with West Virginia Code of State Rules § 148-1-5.2.b.

20. TIME: Time is of the essence with regard to all matters of time and performance in this Contract.

21. APPLICABLE LAW: This Contract is governed by and interpreted under West Virginia law without giving effect to its choice of law principles. Any information provided in specification manuals, or any other source, verbal or written, which contradicts or violates the West Virginia Constitution, West Virginia Code or West Virginia Code of State Rules is void and of no effect.

22. COMPLIANCE WITH LAWS: Vendor shall comply with all applicable federal, state, and local laws, regulations and ordinances. By submitting a bid, Vendor acknowledges that it has reviewed, understands, and will comply with all applicable laws, regulations, and ordinances.

SUBCONTRACTOR COMPLIANCE: Vendor shall notify all subcontractors providing commodities or services related to this Contract that as subcontractors, they too are required to comply with all applicable laws, regulations, and ordinances. Notification under this provision must occur prior to the performance of any work under the contract by the subcontractor.

23. ARBITRATION: Any references made to arbitration contained in this Contract, Vendor's bid, or in any American Institute of Architects documents pertaining to this Contract are hereby deleted, void, and of no effect.

24. MODIFICATIONS: This writing is the parties' final expression of intent. Notwithstanding anything contained in this Contract to the contrary no modification of this Contract shall be binding without mutual written consent of the Agency, and the Vendor, with approval of the Purchasing Division and the Attorney General's office (Attorney General approval is as to form only). Any change to existing contracts that adds work or changes contract cost, and were not included in the original contract, must be approved by the Purchasing Division and the Attorney General's Office (as to form) prior to the implementation of the change or commencement of work affected by the change.

25. WAIVER: The failure of either party to insist upon a strict performance of any of the terms or provision of this Contract, or to exercise any option, right, or remedy herein contained, shall not be construed as a waiver or a relinquishment for the future of such term, provision, option, right, or remedy, but the same shall continue in full force and effect. Any waiver must be expressly stated in writing and signed by the waiving party.

26. SUBSEQUENT FORMS: The terms and conditions contained in this Contract shall supersede any and all subsequent terms and conditions which may appear on any form documents submitted by Vendor to the Agency or Purchasing Division such as price lists, order forms, invoices, sales agreements, or maintenance agreements, and includes internet websites or other electronic documents. Acceptance or use of Vendor's forms does not constitute acceptance of the terms and conditions contained thereon.

27. ASSIGNMENT: Neither this Contract nor any monies due, or to become due hereunder, may be assigned by the Vendor without the express written consent of the Agency, the Purchasing Division, the Attorney General's office (as to form only), and any other government agency or office that may be required to approve such assignments.

28. WARRANTY: The Vendor expressly warrants that the goods and/or services covered by this Contract will: (a) conform to the specifications, drawings, samples, or other description furnished or specified by the Agency; (b) be merchantable and fit for the purpose intended; and (c) be free from defect in material and workmanship.

29. STATE EMPLOYEES: State employees are not permitted to utilize this Contract for personal use and the Vendor is prohibited from permitting or facilitating the same.

30. PRIVACY, SECURITY, AND CONFIDENTIALITY: The Vendor agrees that it will not disclose to anyone, directly or indirectly, any such personally identifiable information or other confidential information gained from the Agency, unless the individual who is the subject of the information consents to the disclosure in writing or the disclosure is made pursuant to the Agency's policies, procedures, and rules. Vendor further agrees to comply with the Confidentiality Policies and Information Security Accountability Requirements, set forth in http://www.state.wv.us/admin/purchase/privacy/default.html.

31. YOUR SUBMISSION IS A PUBLIC DOCUMENT: Vendor's entire response to the Solicitation and the resulting Contract are public documents. As public documents, they will be disclosed to the public following the bid/proposal opening or award of the contract, as required by the competitive bidding laws of West Virginia Code §§ 5A-3-1 et seq., 5-22-1 et seq., and 5G-1-1 et seq. and the Freedom of Information Act West Virginia Code §§ 29B-1-1 et seq.

DO NOT SUBMIT MATERIAL YOU CONSIDER TO BE CONFIDENTIAL, A TRADE SECRET, OR OTHERWISE NOT SUBJECT TO PUBLIC DISCLOSURE.

Submission of any bid, proposal, or other document to the Purchasing Division constitutes your explicit consent to the subsequent public disclosure of the bid, proposal, or document. The Purchasing Division will disclose any document labeled "confidential," "proprietary," "trade secret," "private," or labeled with any other claim against public disclosure of the documents, to include any "trade secrets" as defined by West Virginia Code § 47-22-1 et seq. All submissions are subject to public disclosure without notice.

32. LICENSING: In accordance with West Virginia Code of State Rules § 148-1-6.1.e, Vendor must be licensed and in good standing in accordance with any and all state and local laws and requirements by any state or local agency of West Virginia, including, but not limited to, the West Virginia Secretary of State's Office, the West Virginia Tax Department, West Virginia Insurance Commission, or any other state agency or political subdivision. Obligations related to political subdivisions may include, but are not limited to, business licensing, business and occupation taxes, inspection compliance, permitting, etc. Upon request, the Vendor must provide all necessary releases to obtain information to enable the Purchasing Division Director or the Agency to verify that the Vendor is licensed and in good standing with the above entities.

SUBCONTRACTOR COMPLIANCE: Vendor shall notify all subcontractors providing commodities or services related to this Contract that as subcontractors, they too are required to be licensed, in good standing, and up-to-date on all state and local obligations as described in this section. Obligations related to political subdivisions may include, but are not limited to, business licensing, business and occupation taxes, inspection compliance, permitting, etc. Notification under this provision must occur prior to the performance of any work under the contract by the subcontractor.

33. ANTITRUST: In submitting a bid to, signing a contract with, or accepting a Award Document from any agency of the State of West Virginia, the Vendor agrees to convey, sell, assign, or transfer to the State of West Virginia all rights, title, and interest in and to all causes of action it may now or hereafter acquire under the antitrust laws of the United States and the State of West Virginia for price fixing and/or unreasonable restraints of trade relating to the particular commodities or services purchased or acquired by the State of West Virginia. Such assignment shall be made and become effective at the time the purchasing agency tenders the initial payment to Vendor.

34. VENDOR CERTIFICATIONS: By signing its bid or entering into this Contract, Vendor certifies (1) that its bid or offer was made without prior understanding, agreement, or connection with any corporation, firm, limited liability company, partnership, person or entity submitting a bid or offer for the same material, supplies, equipment or services; (2) that its bid or offer is in all respects fair and without collusion or fraud; (3) that this Contract is accepted or entered into without any prior understanding, agreement, or connection to any other entity that could be considered a violation of law; and (4) that it has reviewed this Solicitation in its entirety; understands the requirements, terms and conditions, and other information contained herein.

Vendor's signature on its bid or offer also affirms that neither it nor its representatives have any interest, nor shall acquire any interest, direct or indirect, which would compromise the performance of its services hereunder. Any such interests shall be promptly presented in detail to the Agency. The individual signing this bid or offer on behalf of Vendor certifies that he or she is authorized by the Vendor to execute this bid or offer or any documents related thereto on Vendor's behalf; that he or she is authorized to bind the Vendor in a contractual relationship; and that, to the best of his or her knowledge, the Vendor has properly registered with any State agency that may require registration.

35. VENDOR RELATIONSHIP: The relationship of the Vendor to the State shall be that of an independent contractor and no principal-agent relationship or employer-employee relationship is contemplated or created by this Contract. The Vendor as an independent contractor is solely liable for the acts and omissions of its employees and agents. Vendor shall be responsible for selecting, supervising, and compensating any and all individuals employed pursuant to the terms of this Solicitation and resulting contract. Neither the Vendor, nor any employees or subcontractors of the Vendor, shall be deemed to be employees of the State for any purpose whatsoever. Vendor shall be exclusively responsible for payment of employees and contractors for all wages and salaries, taxes, withholding payments, penalties, fees, fringe benefits, professional liability insurance premiums, contributions to insurance and pension, or other deferred compensation plans, including but not limited to, Workers' Compensation and Social Security obligations, licensing fees, etc. and the filing of all necessary documents, forms, and returns pertinent to all of the foregoing.

Vendor shall hold harmless the State, and shall provide the State and Agency with a defense against any and all claims including, but not limited to, the foregoing payments, withholdings, contributions, taxes, Social Security taxes, and employer income tax returns.

36. INDEMNIFICATION: The Vendor agrees to indemnify, defend, and hold harmless the State and the Agency, their officers, and employees from and against: (1) Any claims or losses for services rendered by any subcontractor, person, or firm performing or supplying services, materials, or supplies in connection with the performance of the Contract; (2) Any claims or losses resulting to any person or entity injured or damaged by the Vendor, its officers, employees, or subcontractors by the publication, translation, reproduction, delivery, performance, use, or disposition of any data used under the Contract in a manner not authorized by the Contract, or by Federal or State statutes or regulations; and (3) Any failure of the Vendor, its officers, employees, or subcontractors to observe State and Federal laws including, but not limited to, labor and wage and hour laws.

37. PURCHASING AFFIDAVIT: In accordance with West Virginia Code §§ 5A-3-10a and 5-22-1(i), the State is prohibited from awarding a contract to any bidder that owes a debt to the State or a political subdivision of the State, Vendors are required to sign, notarize, and submit the Purchasing Affidavit to the Purchasing Division affirming under oath that it is not in default on any monetary obligation owed to the state or a political subdivision of the state.

38. ADDITIONAL AGENCY AND LOCAL GOVERNMENT USE: This Contract may be utilized by other agencies, spending units, and political subdivisions of the State of West Virginia; county, municipal, and other local government bodies; and school districts ("Other Government Entities"), provided that both the Other Government Entity and the Vendor agree. Any extension of this Contract to the aforementioned Other Government Entities must be on the same prices, terms, and conditions as those offered and agreed to in this Contract, provided that such extension is in compliance with the applicable laws, rules, and ordinances of the Other Government Entity. A refusal to extend this Contract to the Other Government Entities shall not impact or influence the award of this Contract in any manner.

39. CONFLICT OF INTEREST: Vendor, its officers or members or employees, shall not presently have or acquire an interest, direct or indirect, which would conflict with or compromise the performance of its obligations hereunder. Vendor shall periodically inquire of its officers, members and employees to ensure that a conflict of interest does not arise. Any conflict of interest discovered shall be promptly presented in detail to the Agency.

40. REPORTS: Vendor shall provide the Agency and/or the Purchasing Division with the following reports identified by a checked box below:

☐ Such reports as the Agency and/or the Purchasing Division may request. Requested reports may include, but are not limited to, quantities purchased, agencies utilizing the contract, total contract expenditures by agency, etc.

☐ Quarterly reports detailing the total quantity of purchases in units and dollars, along with a listing of purchases by agency. Quarterly reports should be delivered to the Purchasing Division via email at purchasing.requisitions@wv.gov.

41. BACKGROUND CHECK: In accordance with W. Va. Code § 15-2D-3, the Director of the Division of Protective Services shall require any service provider whose employees are regularly employed on the grounds or in the buildings of the Capitol complex or who have access to sensitive or critical information to submit to a fingerprint-based state and federal background inquiry through the state repository. The service provider is responsible for any costs associated with the fingerprint-based state and federal background inquiry.

After the contract for such services has been approved, but before any such employees are permitted to be on the grounds or in the buildings of the Capitol complex or have access to sensitive or critical information, the service provider shall submit a list of all persons who will be physically present and working at the Capitol complex to the Director of the Division of Protective Services for purposes of verifying compliance with this provision. The State reserves the right to prohibit a service provider's employees from accessing sensitive or critical information or to be present at the Capitol complex based upon results addressed from a criminal background check.

Service providers should contact the West Virginia Division of Protective Services by phone at (304) 558-9911 for more information.

42. PREFERENCE FOR USE OF DOMESTIC STEEL PRODUCTS: Except when authorized by the Director of the Purchasing Division pursuant to W. Va. Code § 5A-3-56, no contractor may use or supply steel products for a State Contract Project other than those steel products made in the United States. A contractor who uses steel products in violation of this section may be subject to civil penalties pursuant to W. Va. Code § 5A-3-56. As used in this section:

a. "State Contract Project" means any erection or construction of, or any addition to, alteration of or other improvement to any building or structure, including, but not limited to, roads or highways, or the installation of any heating or cooling or ventilating plants or other equipment, or the supply of and materials for such projects, pursuant to a contract with the State of West Virginia for which bids were solicited on or after June 6, 2001.

b. "Steel Products" means products rolled, formed, shaped, drawn, extruded, forged, cast, fabricated or otherwise similarly processed, or processed by a combination of two or more or such operations, from steel made by the open heath, basic oxygen, electric furnace, Bessemer or other steel making process. The Purchasing Division Director may, in writing, authorize the use of foreign steel products if:

c. The cost for each contract item used does not exceed one tenth of one percent (.1%) of the total contract cost or two thousand five hundred dollars ($2,500.00), whichever is greater. For the purposes of this section, the cost is the value of the steel product as delivered to the project; or

d. The Director of the Purchasing Division determines that specified steel materials are not produced in the United States in sufficient quantity or otherwise are not reasonably available to meet contract requirements.

43. PREFERENCE FOR USE OF DOMESTIC ALUMINUM, GLASS, AND STEEL: In Accordance with W. Va. Code § 5-19-1 et seq., and W. Va. CSR § 148-10-1 et seq., for every contract or subcontract, subject to the limitations contained herein, for the construction, reconstruction, alteration, repair, improvement or maintenance of public works or for the purchase of any item of machinery or equipment to be used at sites of public works, only domestic aluminum, glass or steel products shall be supplied unless the spending officer determines, in writing, after the receipt of offers or bids, (1) that the cost of domestic aluminum, glass or steel products is unreasonable or inconsistent with the public interest of the State of West Virginia, (2) that domestic aluminum, glass or steel products are not produced in sufficient quantities to meet the contract requirements, or (3) the available domestic aluminum, glass, or steel do not meet the contract specifications. This provision only applies to public works contracts awarded in an amount more than fifty thousand dollars ($50,000) or public works contracts that require more than ten thousand pounds of steel products.

The cost of domestic aluminum, glass, or steel products may be unreasonable if the cost is more than twenty percent (20%) of the bid or offered price for foreign made aluminum, glass, or steel products. If the domestic aluminum, glass or steel products to be supplied or produced in a

"substantial labor surplus area", as defined by the United States Department of Labor, the cost of domestic aluminum, glass, or steel products may be unreasonable if the cost is more than thirty percent (30%) of the bid or offered price for foreign made aluminum, glass, or steel products. This preference shall be applied to an item of machinery or equipment, as indicated above, when the item is a single unit of equipment or machinery manufactured primarily of aluminum, glass or steel, is part of a public works contract and has the sole purpose or of being a permanent part of a single public works project. This provision does not apply to equipment or machinery purchased by a spending unit for use by that spending unit and not as part of a single public works project.

All bids and offers including domestic aluminum, glass or steel products that exceed bid or offer prices including foreign aluminum, glass or steel products after application of the preferences provided in this provision may be reduced to a price equal to or lower than the lowest bid or offer price for foreign aluminum, glass or steel products plus the applicable preference. If the reduced bid or offer prices are made in writing and supersede the prior bid or offer prices, all bids or offers, including the reduced bid or offer prices, will be reevaluated in accordance with this rule.

44. INTERESTED PARTY SUPPLEMENTAL DISCLOSURE: W. Va. Code § 6D-1-2 requires that for contracts with an actual or estimated value of at least $1 million, the vendor must submit to the Agency a supplemental disclosure of interested parties reflecting any new or differing interested parties to the contract, which were not included in the original pre-award interested party disclosure, within 30 days following the completion or termination of the contract. A copy of that form is included with this solicitation or can be obtained from the WV Ethics Commission. This requirement does not apply to publicly traded companies listed on a national or international stock exchange. A more detailed definition of interested parties can be obtained from the form referenced above.

DESIGNATED CONTACT: Vendor appoints the individual identified in this Section as the Contract Administrator and the initial point of contact for matters relating to this Contract.

Bill Harland, Vice President of Marketing

(Name, Title)

Electronics Research, Inc.

(Printed Name and Title)

7777 Gardner Road, Chandler, IN 47610

(Address)

+1 (812) 925-6000 / +1 (812) 925-4030

(Phone Number) / (Fax Number)

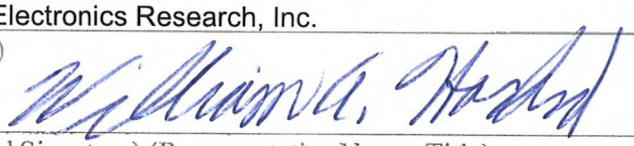
bharland@eriinc.com

(email address)

CERTIFICATION AND SIGNATURE: By signing below, or submitting documentation through wvOASIS, I certify that I have reviewed this Solicitation in its entirety; that I understand the requirements, terms and conditions, and other information contained herein; that this bid, offer or proposal constitutes an offer to the State that cannot be unilaterally withdrawn; that the product or service proposed meets the mandatory requirements contained in the Solicitation for that product or service, unless otherwise stated herein; that the Vendor accepts the terms and conditions contained in the Solicitation, unless otherwise stated herein; that I am submitting this bid, offer or proposal for review and consideration; that I am authorized by the vendor to execute and submit this bid, offer, or proposal, or any documents related thereto on vendor's behalf; that I am authorized to bind the vendor in a contractual relationship; and that to the best of my knowledge, the vendor has properly registered with any State agency that may require registration.

Electronics Research, Inc.

(Company)



(Authorized Signature) (Representative Name, Title)

William A. Harland, Vice President of Marketing

(Printed Name and Title of Authorized Representative)

August 13, 2019

(Date)

+1 (812) 925-6000 / +1 (812) 925-4030

(Phone Number) (Fax Number)

SPECIFICATIONS

1. **PURPOSE AND SCOPE:** The West Virginia Purchasing Division is soliciting bids on behalf of the West Virginia Educational Broadcasting Authority (Agency) to establish a contract for the one-time purchase of a High-Power UHF Television Transmit Antenna.

2. **DEFINITIONS:** The terms listed below shall have the meanings assigned to them below. Additional definitions can be found in section 2 of the General Terms and Conditions.

   2.1 Contract Item: means a High-Power UHF Television Transmit Antenna as more fully described by these specifications.

   2.2 Elliptical Polarization: An antenna is said to be vertically polarized (linear) when its electric field is perpendicular to the Earth's surface. If the axial ratio is near 0 dB (decibel), the antenna is said to be circular polarized. If the axial ratio is greater than 1-2 dB, the polarization is often referred to as elliptical.

   2.3 Horizontal Azimuth Pattern: horizontal angle radiation measured clockwise from any fixed reference plane or easily established base direction line.

   2.4 Moment Arm: the length between a joint axis and the line of force acting on that joint. Every joint that is involved in an exercise has a moment arm. The longer the moment arm is the more load will be applied to the joint axis through leverage.

   2.5 Pricing Page: the page(s), contained in wvOASIS or attached as Exhibit A, upon which Vendor should list its proposed price for the Contract Items.

   2.6 Radome: a dome or other structure protecting radar equipment and made from material transparent to radio waves, especially one on the outer surface of an aircraft.

   2.7 Solicitation: means the official notice of an opportunity to supply the State with goods or services that is published by the Purchasing Division.

3. **GENERAL REQUIREMENTS:**

   3.1 Mandatory Contract Item Requirements: Contract Item must meet or exceed the mandatory requirements listed below.

   3.1.1 High-Power UHF Television Transmit Antenna

   3.1.1.1 Mechanical Specifications

   3.1.1.1.1 All structural elements shall be designed and fabricated in accordance with TIA/EIA standard RS-222G, Structural Standards for Steel Antenna, Towers,

and Supporting structures. Download available here: Structural Standards for Antennae and Towers. A building markup (Exhibit B) is attached to facilitate this.

3.1.1.1.2 All hardware shall be constructed of non-ferrous material or be galvanized:

3.1.1.1.2.1 Steel elements shall be hot-dip galvanized in accordance with the ASTM A123 standard available here: ASTM A123 Standard

3.1.1.1.2.2 Zinc coating shall be applied with a minimum thickness of 0.002 inches (0.5mm)

3.1.1.1.3 Physical Antenna attributes:

3.1.1.1.3.1 Antenna shall be top mounted

3.1.1.1.3.2 Radiating elements shall be protected from ice by being enclosed in a Radome

3.1.1.1.3.3 Vendor shall provide mechanical interface between top of steel and antenna

3.1.1.1.3.4 Weight without ice shall be less than 5000 pounds

3.1.1.1.3.5 Effective Projected Area (wind load) shall be less than 40 square feet (3.7 square meters)

3.1.1.1.3.6 Moment arm shall be less than 22 feet (6.7 Meters)

3.1.1.2 Electrical specifications:

3.1.1.2.1 Polarization shall be elliptical

3.1.1.2.2 The Horizontal Azimuth Pattern shall meet the parameters defined in the Attachment provided (PDF of Construction permit on file with the FCC – Exhibit C)

3.1.1.3 Transmission Line and Accessories:

3.1.1.3.1 Vendor shall provide Transmission Line able to operate with 30 Kilowatts DTV (Digital Television) power

3.1.1.3.1.1 Current transmission line is 3 1/8" EIA.

3.1.1.3.2 Vendor shall provide all Transmission Line components for complete installation. Components shall include but not be limited to: Hangers, hoisting adapters, Elbows, Field terminated line sections, transformers, and pressure windows.

4. CONTRACT AWARD:

4.1 Contract Award: The Contract is intended to provide Agencies with a purchase price for the Contract Items. The Contract shall be awarded to the Vendor that provides the Contract Items meeting the required specifications for the lowest overall total cost as shown on the Pricing Pages (Exhibit A).

4.2 Pricing Page: Vendor should complete the Pricing Page (Exhibit A) by filling the table with the appropriate information. Vendor should complete the Pricing Page in full as failure to complete the Pricing Page in its entirety may result in Vendor's bid being disqualified.

4.2.1 Vendor should complete the Pricing Page (Exhibit A) by listing a Unit Cost for each Contract Item, multiplying this unit cost by the given quantity, and listing the result as a Total Item Cost for each Contract Item. Vendor should then enter a sum of all Total Item Costs in the Total Bid Cost field.

4.2.2 Shipping costs shall be included in the price of equipment.

4.2.3 Vendor must include additional documentation for all equipment and components to sufficiently demonstrate that all equipment and components meet specifications. Vendor should include this documentation with their bid.

4.2.4 Vendor should type or electronically enter the information into the Pricing Page (Exhibit A) to prevent errors in the evaluation

4.2.5 The total cost of the bid shall be the "Total Bid Cost" as described in section 4.2.1

4.2.6 The winning Vendor shall be the vendor submitting the bid with the lowest total cost

4.2.7 If no vendor submits a bid within the budget limitations of the Agency, the Agency may, at its own discretion, cancel this RFQ and purchase nothing.

Vendor should type or electronically enter the information into the Pricing Page to prevent errors in the evaluation.

5. PAYMENT:

5.1 Payment: Vendor shall accept payment in accordance with the payment procedures of the State of West Virginia.

6. DELIVERY AND RETURN:

6.1 Shipment and Delivery: Vendor shall deliver the Contract Items within 120 calendar days of being awarded this Contract and receiving a purchase order or notice to proceed. Contract Items must be delivered to Agency at the following address:

WV Educational Broadcasting Authority
Attn: Art Austin
WNPB Transmitter Site
2095 Sand Springs Road
Morgantown WV 26508

Vendor must give the Agency a minimum notice of 10 business days prior to the arrival of the Contract Items on site to permit preparation for off-loading.

6.2 Late Delivery: The Agency placing the order under this Contract must be notified in writing if the shipment of the Contract Items will be delayed for any reason. Any delay in delivery that could cause harm to an Agency will be grounds for cancellation of the Contract, and/or obtaining the Contract Items from a third party.

Any Agency seeking to obtain the Contract Items from a third party under this provision must first obtain approval of the Purchasing Division.

6.3 Delivery Payment/Risk of Loss: Vendor shall deliver the Contract Items F.O.B. destination to the Agency's location.

6.4 Return of Unacceptable Items: If the Agency deems the Contract Items to be unacceptable, the Contract Items shall be returned to Vendor at Vendor's expense and with no restocking charge. Vendor shall either make arrangements for the return within five (5) days of being notified that items are unacceptable or permit the Agency to arrange for the return and reimburse Agency for delivery expenses. If the original packaging cannot be utilized for the return, Vendor will supply the Agency with appropriate return packaging upon request. All returns of unacceptable items shall be F.O.B. the Agency's location. The returned product shall either be replaced, or the Agency shall receive a full credit or refund for the purchase price, at the Agency's discretion.

6.5 Return Due to Agency Error: Items ordered in error by the Agency will be returned for credit within 30 days of receipt, F.O.B. Vendor's location. Vendor shall not charge a restocking fee if returned products are in a resalable condition. Items shall be deemed to be in a resalable condition if they are unused and in the original packaging. Any restocking fee for items not in a resalable condition shall be the lower of the Vendor's customary restocking fee or 5% of the total invoiced value of the returned items.

7 VENDOR DEFAULT:

7.1 The following shall be considered a vendor default under this Contract.

7.1.1 Failure to provide Contract Items in accordance with the requirements contained herein.

7.1.2 Failure to comply with other specifications and requirements contained herein.

7.1.3 Failure to comply with any laws, rules, and ordinances applicable to the Contract Services provided under this Contract.

7.1.4 Failure to remedy deficient performance upon request.

7.2 The following remedies shall be available to Agency upon default.

7.2.1 Immediate cancellation of the Contract.

7.2.2 Immediate cancellation of one or more release orders issued under this Contract.

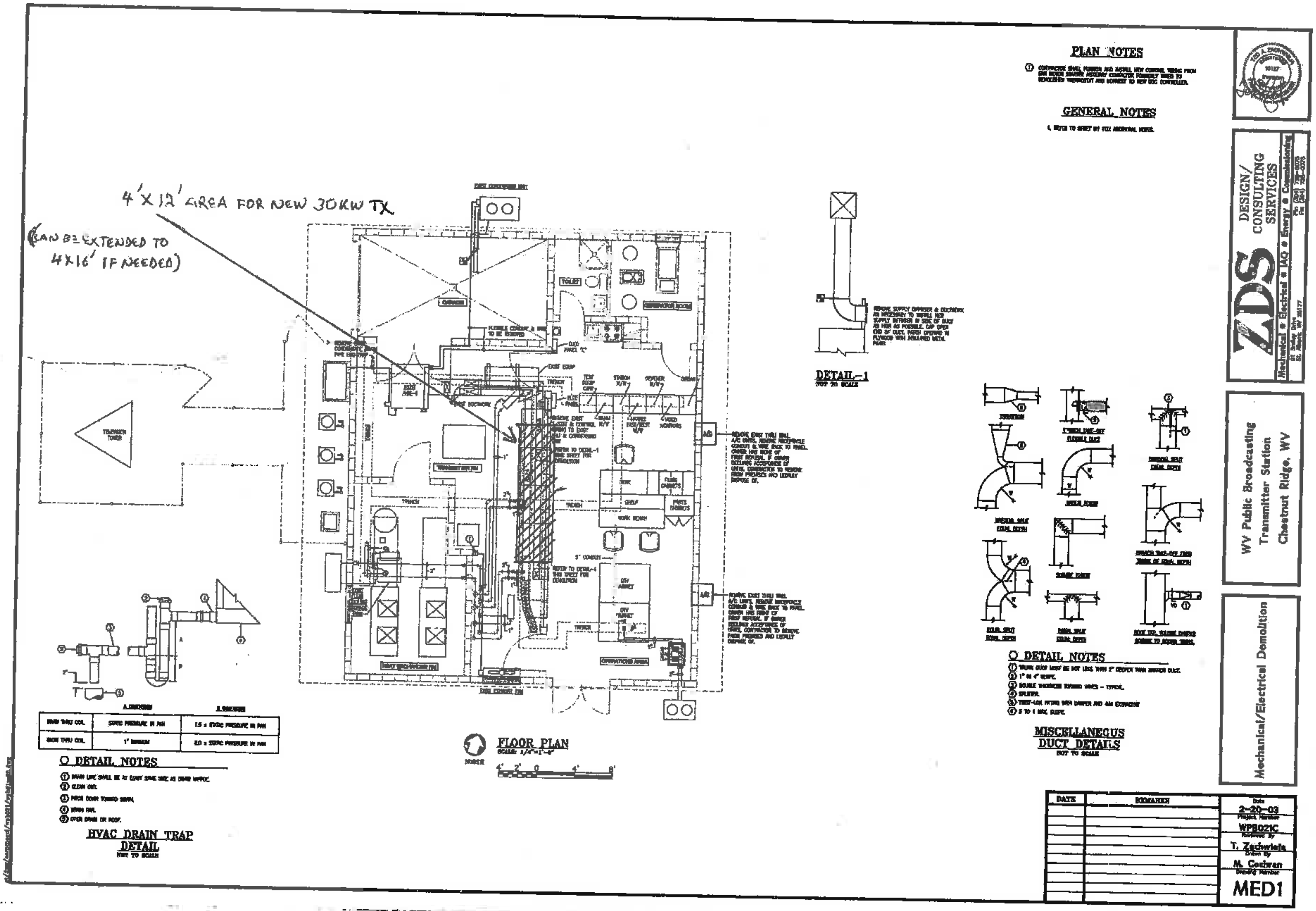
7.2.3 Any other remedies available in law or equity.

Exhibit A
Pricing Page*

em#	Description	Quan	Unit Cost	Total Item Cost
1	High-Power UHF Television Transmit Antenna as described in section 3.1.1	1	$298,240.00	$ 298,240.00
	Total Bid Cost			$ 298,240.00

***Per section 4.2.3 Vendor must also provide documentation for the equipment quoted sufficient for the Agency to determine whether the quoted equipment meets specifications. Vendor should provide this documentation with their initial bid.**

Authorized Signature: William H. Hardy Date: Aug 13, 2019



4'X12' AREA FOR NEW 30KW TX
(CAN BE EXTENDED TO 4X16' IF NEEDED)
PLAN NOTES
GENERAL NOTES
DETAIL-1
NOT TO SCALE
FLOOR PLAN
MISCELLANEOUS DUCT DETAILS
NOT TO SCALE
DETAIL NOTES
HVAC DRAIN TRAP DETAIL
NOT TO SCALE
ZDS
DESIGN/ CONSULTING SERVICES
Mechanical • Electrical • IAQ • Energy • Commissioning
WV Public Broadcasting
Transmitter Station
Chestnut Ridge, WV
Mechanical/Electrical Demolition
DATE
REMARKS
2-20-03
WPB021C
T. Zachwieja
M. Cochran
MED1

Antenna Technical Data

Section	Question	Response
Antenna Type	Antenna Type	Directional Custom
	Do you have an Antenna ID?	No
	Antenna ID	1002420
Antenna Manufacturer and Model	Manufacturer:	Dielectric
	Model	TFU-16GTH-R C170
	Rotation	180 degrees
	Electrical Beam Tilt	1.0
	Mechanical Beam Tilt	Not Applicable
	toward azimuth	
	Polarization	Elliptical
DTV and DTS: Elevation Pattern	Does the proposed antenna propose elevation radiation patterns that vary with azimuth for reasons other than the use of mechanical beam tilt?	No
	Uploaded file for elevation antenna (or radiation) pattern data	

Directional Antenna Relative Field Values (Pre-rotated Pattern)

Degree	V_A (Authorized Value)	Degree	V_A (Authorized Value)	Degree	V_A (Authorized Value)	Degree	V_A (Authorized Value)
0	0.899	90	0.940	180	0.245	270	0.940
10	0.900	100	0.854	190	0.232	280	0.987
20	0.905	110	0.733	200	0.207	290	1.000
30	0.917	120	0.588	210	0.218	300	0.988
40	0.936	130	0.437	220	0.302	310	0.963
50	0.963	140	0.302	230	0.437	320	0.936
60	0.988	150	0.218	240	0.588	330	0.917
70	1.000	160	0.207	250	0.733	340	0.905
80	0.987	170	0.232	260	0.854	350	0.900

Additional Azimuths

Degree	V_A
71	1.00
289	1.00
204	0.204
156	0.204

Purchasing Divison
2019 Washington Street East
Post Office Box 50130
Charleston, WV 25305-0130

State of West Virginia
Request for Quotation
04 — Audio/Video

Proc Folder: 609036

Doc Description: Addendum #1 HIGH POWER UHF TELEVISION TRASMIT ANTENNA

Proc Type: Central Purchase Order

Date Issued	Solicitation Closes	Solicitation No	Version
2019-08-09	2019-08-14 13:30:00	CRFQ 0439 EBA2000000004	2

BID RECEIVING LOCATION

BID CLERK
DEPARTMENT OF ADMINISTRATION
PURCHASING DIVISION
2019 WASHINGTON ST E
CHARLESTON WV 25305
US

VENDOR

Vendor Name, Address and Telephone Number:

Electronics Research, Inc.
7777 Gardner Road
Chandler, IN 47610
+1 (812) 925-6000
Bill Harland, Vice President of Marketing
bharland@eriinc.com

FOR INFORMATION CONTACT THE BUYER

Stephanie L Gale
(304) 558-8801
stephanie.l.gale@wv.gov

Signature X [signature] **FEIN #** 35-1083384 **DATE** August 13, 2019

All offers subject to all terms and conditions contained in this solicitation

ADDITIONAL INFORMATION:

Addendum #1 issued to:

1. Provide responses to technical questions.

End of Addendum #1.

INVOICE TO	SHIP TO
CHIEF FINANCIAL OFFICER EDUCATIONAL BROADCASTING 124 INDUSTRIAL PARK RD BEAVER WV 25813 US	SITE MANAGER EDUCATIONAL BROADCASTING WNPB-TV 191 SCOTT AVE MORGANTOWN WV 26505 US

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Total Price
1	HIGH POWER UHF TV TRANSMIT ANTENNA	1.00000	EA	$298,240.00	$298,240.00

Comm Code	Manufacturer	Specification	Model #
43221703	Electronics Research, Inc.	20190810-396	ATW21H4-ETC170-34H

Extended Description :

HIGH POWER UHF TV TRANSMIT ANTENNA

SOLICITATION NUMBER: CRFQ EBA2000000004
Addendum Number: 1

The purpose of this addendum is to modify the solicitation identified as ("Solicitation") to reflect the change(s) identified and described below.

Applicable Addendum Category:

[ ] Modify bid opening date and time

[ ] Modify specifications of product or service being sought

[✓] Attachment of vendor questions and responses

[ ] Attachment of pre-bid sign-in sheet

[ ] Correction of error

[ ] Other

Description of Modification to Solicitation:

Addendum #1 issued to:

1. Provide responses to technical questions.

End of Addendum #1.

Additional Documentation: Documentation related to this Addendum (if any) has been included herewith as Attachment A and is specifically incorporated herein by reference.

Terms and Conditions:

1. All provisions of the Solicitation and other addenda not modified herein shall remain in full force and effect.

2. Vendor should acknowledge receipt of all addenda issued for this Solicitation by completing an Addendum Acknowledgment, a copy of which is included herewith. Failure to acknowledge addenda may result in bid disqualification. The addendum acknowledgement should be submitted with the bid to expedite document processing.

Questions from vendor #1:

In regard to bid request for High Power UHF Television Transit Antenna I have the following questions:

1. Is this replacing an existing top mounted antenna and if so what make and model?

   Answer: This project replaces the existing antenna on the top of the tower- currently a Dielectric model TFU-225-JTH-R S230 operating on Channel 33

2. Are mechanical drawings of the existing installation available?

   Answer: See Exhibit A (attached).

3. Are details of the tower top bolt hole pattern and through hole available?

   Answer: See Exhibit A (attached).

4. What is the distance from transmitter output to tower base?

   Answer: See Exhibit B, markup of the building indicating the position of the mask filter attachment (attached).

5. What is the desired ratio between horizontal polarization and vertical polarization?

   Answer: Vertical Polarization shall be 30 percent of the horizontal component.

6. What is the desired peak gain in horizontal polarization?

   Answer: Referring to the Construction Permit the antenna and transmission line shall produce 660,000 Watts ERP with a post mask filter power level of 28,000 watts.

7. What is the desired peak gain in vertical polarization?

   Answer: We would like the vertical pattern to match the horizontal pattern as much as is practical.

8. What is the desired minimum power rating of the antenna?

   Answer: Antenna shall accommodate full power output of the transmitter (30 KW) using both ATSC 1 and ATSC 3 modulation properties.

9. Can a site visit be scheduled before bid deadline?

   Answer: If our time frame for this project wasn't so tight we would permit visits just as a courtesy, but we don't have time for unnecessary delays and we believe we have provided sufficient documentation and specifications that a pre-bid site visit is unnecessary. The winning vendor is free to visit the site for any measurements or verification they feel they would need, but they should budget that into their bid.

Questions from vendor #2:

Questions regarding Solicitation CRFQ 0439 EBA2000000004,0 for a new high-power UHF television antenna for WNPB-TV, Morgantown:

1. The bid document references a Dielectric Model TFU18GTH-R C170 UHF Television Antenna. The FCC Licensing and Management System indicates a Dielectric Model TFU16GTH-R C170. The Model numbers indicate significant different antenna gain. Would you please clarify by specifying the required peak gain for the horizontal polarization of the antenna to be supplied?

   Answer: There is a possibility of a number error in the filing – the number is the FCC CP is a placeholder pending selection and installation of the antenna. The System (antenna, transmission line, transformer, and matching section shall produce 660,000 watts ERP with 28KW at the output of the mask filter.

2. Would you also please specify the desired ERP for the vertical polarization, either as a percentage of the horizontal polarization ERP or as an antenna peak gain figure?

   Answer: Vertical Polarization shall be 30 percent of the horizontal component.

3. Would you please provide an estimated length for the horizontal and vertical transmission line runs?

   Answer: Attached is a markup of the building (Exhibit B) indicating the position of the mask filter attachment.

4. Can you please provide the bolt circle diameter, number of bolt holes and bolt hole diameter for the tower top antenna mounting flange?

   Answer: See Exhibit A (attached).

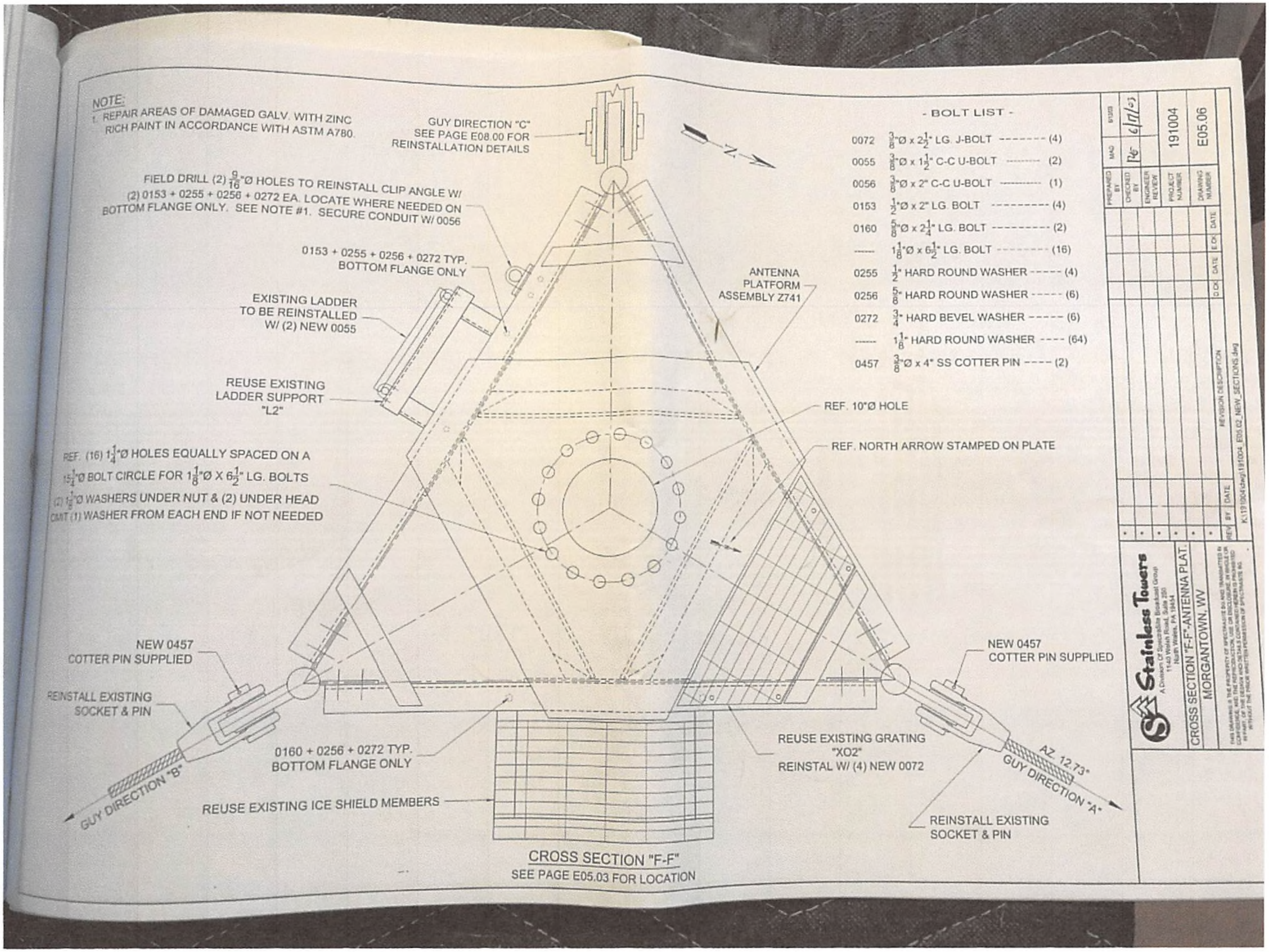

NOTE:
1. REPAIR AREAS OF DAMAGED GALV. WITH ZINC RICH PAINT IN ACCORDANCE WITH ASTM A780.
GUY DIRECTION "C"
SEE PAGE E08.00 FOR REINSTALLATION DETAILS
FIELD DRILL (2) 9/16"Ø HOLES TO REINSTALL CLIP ANGLE W/ (2) 0153 + 0255 + 0256 + 0272 EA. LOCATE WHERE NEEDED ON BOTTOM FLANGE ONLY. SEE NOTE #1. SECURE CONDUIT W/ 0056
0153 + 0255 + 0256 + 0272 TYP. BOTTOM FLANGE ONLY
EXISTING LADDER TO BE REINSTALLED W/ (2) NEW 0055
REUSE EXISTING LADDER SUPPORT "L2"
REF. (16) 1 1/4"Ø HOLES EQUALLY SPACED ON A 15 1/2"Ø BOLT CIRCLE FOR 1 1/8"Ø X 6 1/2" LG. BOLTS
(2) 1 1/8"Ø WASHERS UNDER NUT & (2) UNDER HEAD
OMIT (1) WASHER FROM EACH END IF NOT NEEDED
N
ANTENNA PLATFORM ASSEMBLY Z741
- BOLT LIST -
0072 3/8"Ø x 2 1/2" LG. J-BOLT -------- (4)
0055 3/8"Ø x 1 1/2" C-C U-BOLT -------- (2)
0056 3/8"Ø x 2" C-C U-BOLT -------- (1)
0153 1/2"Ø x 2" LG. BOLT -------- (4)
0160 5/8"Ø x 2 1/4" LG. BOLT -------- (2)
------ 1 1/8"Ø x 6 1/2" LG. BOLT -------- (16)
0255 1/2" HARD ROUND WASHER ------ (4)
0256 5/8" HARD ROUND WASHER ------ (6)
0272 3/4" HARD BEVEL WASHER ------ (6)
------ 1 1/8" HARD ROUND WASHER ---- (64)
0457 3/8"Ø x 4" SS COTTER PIN ---- (2)
REF. 10"Ø HOLE
REF. NORTH ARROW STAMPED ON PLATE
NEW 0457 COTTER PIN SUPPLIED
REINSTALL EXISTING SOCKET & PIN
NEW 0457 COTTER PIN SUPPLIED
0160 + 0256 + 0272 TYP. BOTTOM FLANGE ONLY
REUSE EXISTING GRATING "XO2" REINSTAL W/ (4) NEW 0072
GUY DIRECTION "B"
REUSE EXISTING ICE SHIELD MEMBERS
AZ. 12.73°
GUY DIRECTION "A"
REINSTALL EXISTING SOCKET & PIN
CROSS SECTION "F-F"
SEE PAGE E05.03 FOR LOCATION
6/17/03
191004
E05.06
PREPARED BY
CHECKED BY
ENGINEER REVIEW
PROJECT NUMBER
DRAWING NUMBER
REVISION DESCRIPTION
REV BY DATE
K:\191004\dwg\191004_E05.02_NEW_SECTIONS.dwg
Stainless Towers
CROSS SECTION "F-F" ANTENNA PLAT.
MORGANTOWN, WV

Exhibit B, View 2

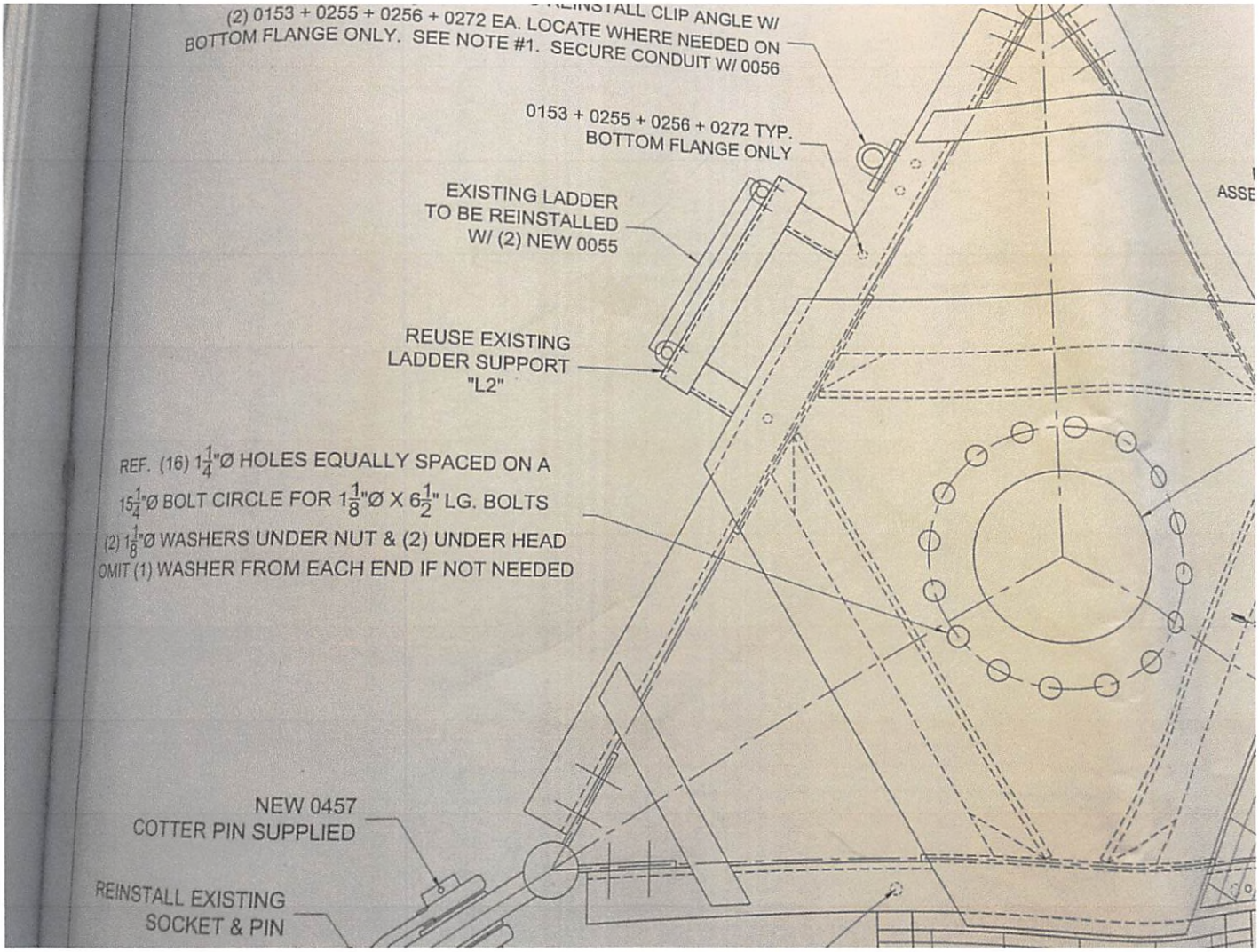


Exhibit A, View 1

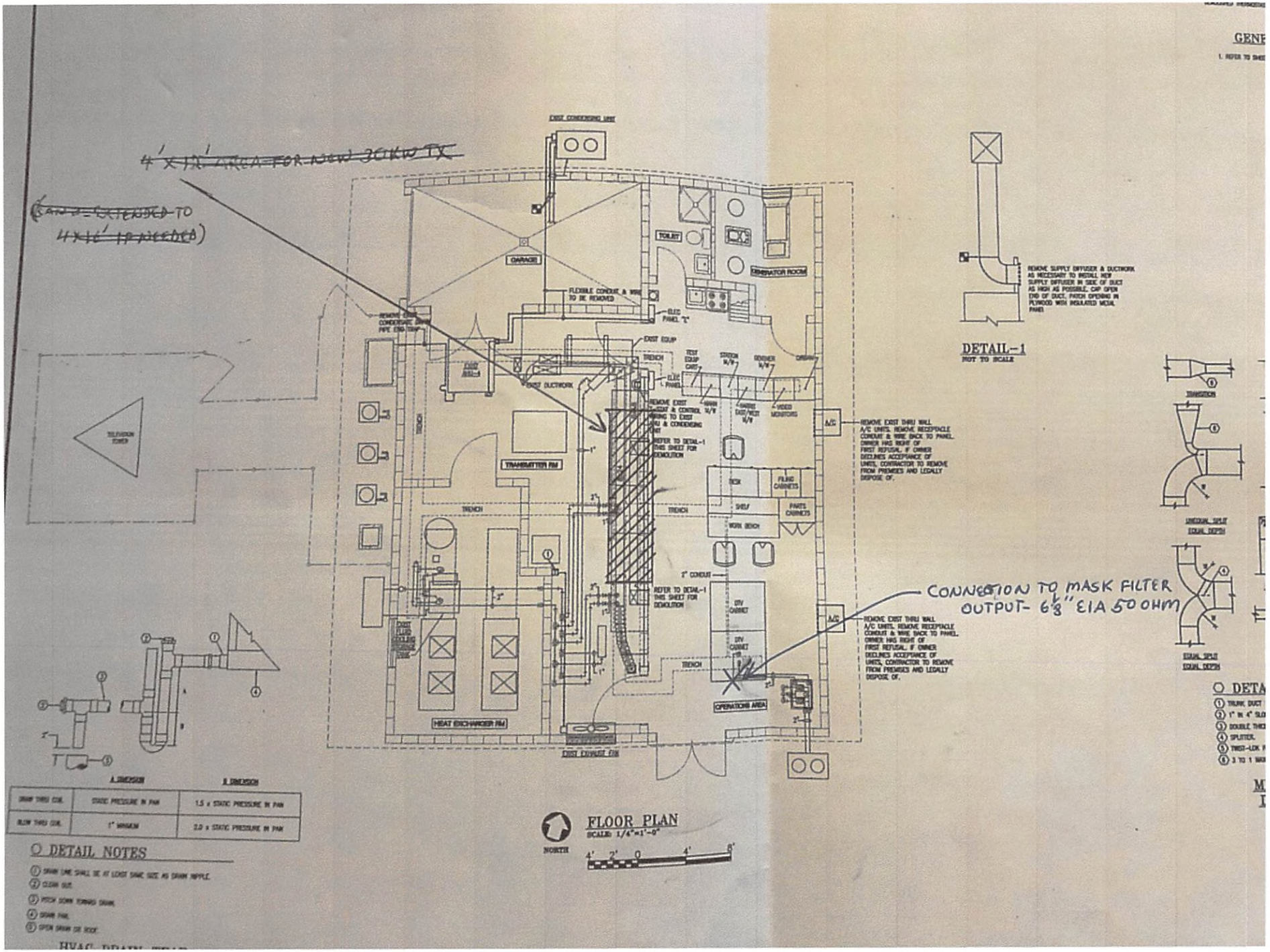
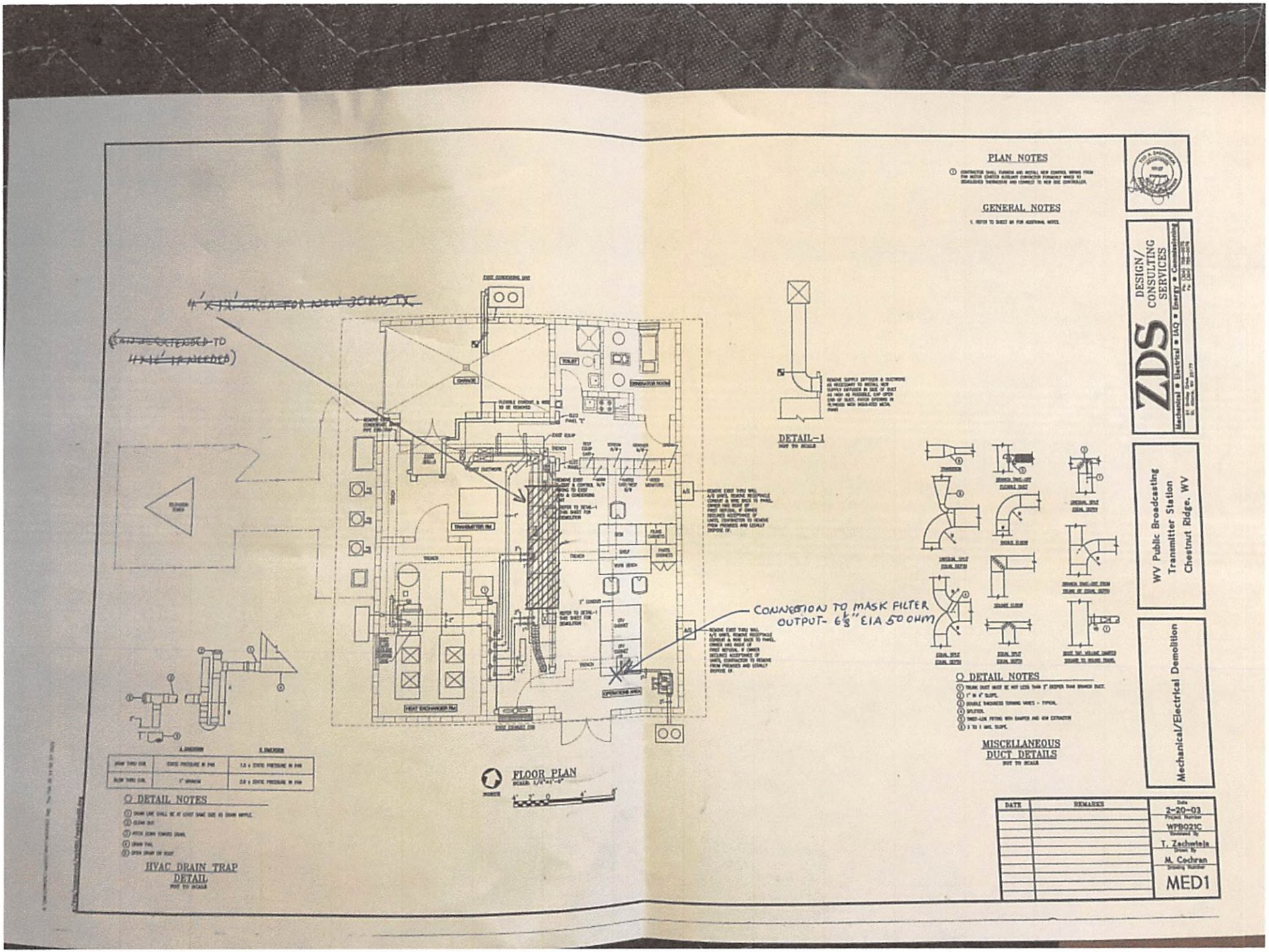


Exhibit A, View 2



ADDENDUM ACKNOWLEDGEMENT FORM
SOLICITATION NO.: CRFQ 0439 EBA2000000004

Instructions: Please acknowledge receipt of all addenda issued with this solicitation by completing this addendum acknowledgment form. Check the box next to each addendum received and sign below. Failure to acknowledge addenda may result in bid disqualification.

Acknowledgment: I hereby acknowledge receipt of the following addenda and have made the necessary revisions to my proposal, plans and/or specification, etc.

Addendum Numbers Received:
(Check the box next to each addendum received)

[X]	Addendum No. 1	[ ]	Addendum No. 6
[ ]	Addendum No. 2	[ ]	Addendum No. 7
[ ]	Addendum No. 3	[ ]	Addendum No. 8
[ ]	Addendum No. 4	[ ]	Addendum No. 9
[ ]	Addendum No. 5	[ ]	Addendum No. 10

I understand that failure to confirm the receipt of addenda may be cause for rejection of this bid. I further understand that any verbal representation made or assumed to be made during any oral discussion held between Vendor's representatives and any state personnel is not binding. Only the information issued in writing and added to the specifications by an official addendum is binding.

Electronics Research, Inc.
Company

William A. Harland
William A. Harland **Authorized Signature**

August 13, 2019
Date

NOTE: This addendum acknowledgement should be submitted with the bid to expedite document processing.
Revised 6/8/2012

STATE OF WEST VIRGINIA
Purchasing Division

PURCHASING AFFIDAVIT

CONSTRUCTION CONTRACTS: Under W. Va. Code § 5-22-1(i), the contracting public entity shall not award a construction contract to any bidder that is known to be in default on any monetary obligation owed to the state or a political subdivision of the state, including, but not limited to, obligations related to payroll taxes, property taxes, sales and use taxes, fire service fees, or other fines or fees.

ALL CONTRACTS: Under W. Va. Code §5A-3-10a, no contract or renewal of any contract may be awarded by the state or any of its political subdivisions to any vendor or prospective vendor when the vendor or prospective vendor or a related party to the vendor or prospective vendor is a debtor and: (1) the debt owed is an amount greater than one thousand dollars in the aggregate; or (2) the debtor is in employer default.

EXCEPTION: The prohibition listed above does not apply where a vendor has contested any tax administered pursuant to chapter eleven of the W. Va. Code, workers' compensation premium, permit fee or environmental fee or assessment and the matter has not become final or where the vendor has entered into a payment plan or agreement and the vendor is not in default of any of the provisions of such plan or agreement.

DEFINITIONS:

"Debt" means any assessment, premium, penalty, fine, tax or other amount of money owed to the state or any of its political subdivisions because of a judgment, fine, permit violation, license assessment, defaulted workers' compensation premium, penalty or other assessment presently delinquent or due and required to be paid to the state or any of its political subdivisions, including any interest or additional penalties accrued thereon.

"Employer default" means having an outstanding balance or liability to the old fund or to the uninsured employers' fund or being in policy default, as defined in W. Va. Code § 23-2c-2, failure to maintain mandatory workers' compensation coverage, or failure to fully meet its obligations as a workers' compensation self-insured employer. An employer is not in employer default if it has entered into a repayment agreement with the Insurance Commissioner and remains in compliance with the obligations under the repayment agreement.

"Related party" means a party, whether an individual, corporation, partnership, association, limited liability company or any other form or business association or other entity whatsoever, related to any vendor by blood, marriage, ownership or contract through which the party has a relationship of ownership or other interest with the vendor so that the party will actually or by effect receive or control a portion of the benefit, profit or other consideration from performance of a vendor contract with the party receiving an amount that meets or exceed five percent of the total contract amount.

AFFIRMATION: By signing this form, the vendor's authorized signer affirms and acknowledges under penalty of law for false swearing (*W. Va. Code* §61-5-3) that: (1) for construction contracts, the vendor is not in default on any monetary obligation owed to the state or a political subdivision of the state, and (2) for all other contracts, that neither vendor nor any related party owe a debt as defined above and that neither vendor nor any related party are in employer default as defined above, unless the debt or employer default is permitted under the exception above.

WITNESS THE FOLLOWING SIGNATURE:

Vendor's Name: Electronics Research, Inc.

Authorized Signature: _____ Date: 08/01/2019

State of Indiana

County of Warrick, to-wit:

Taken, subscribed, and sworn to before me this 1 day of August, 2019.

My Commission expires September 17, 2022.

AFFIX SEAL HERE

STATE OF INDIANA NOTARY SEAL

CINDY D TOMES
Notary Public, State of Indiana
Warrick County
Commission # 658197
My Commission Expires
September 17, 2022

NOTARY PUBLIC _____

ERI Bid Support Information

Request for Quotation: CRFQ EBA2000000004
High Power UHF Television Transmit Antenna
WNPB-TV, RF Channel 34, Morgantown, West Virginia
ERI Proposal Number: 20190810-396

Date Prepared: August 13, 2019

Submitted to: Bid Clerk
Department of Administration
Purchasing Division
State of West Virginia
2019 Washington St E
Charleston WV 25305

ERI Contact: Bill Harland
Vice President of Marketing
Electronics Research, Inc.
7777 Gardner Road
Chandler, IN 47610
+1 (812) 925-6000, Ext. 214 (office)
+1 (812) 455-1823 (cell)
bharland@eriinc.com

Executive Summary

ERI proposes with response to Purchasing Division Request for Quotation for a High-Power UHF Television Antenna and Transmission Line components for WNPB-TV, RF Channel 34, Morgantown. The antenna proposed is an ERI Model ATW21H4-ETC170-34H TRASAR® with a run of 6-1/8-inch, 75 ohm, MACXLine®. The antenna and transmission line components price quoted includes material transportation to site and also includes a system sweep by ERI Field Service, which includes optimization of the transmission line system return loss performance, with the assistance of the customer supplied installation crew.

Immediately following this section is a summary of all the deviations from the CRFQ requirements and specifications as well as highlighting specifications and performance that can be modified without impacting the system cost or jeopardizing the ability to meet the required delivery time frame of 120 day following contract award.

Deviations from CRFQ Specifications and Requirements

Included in this document are Preliminary Electrical and Mechanical Specifications for the TRASAR UHF television antenna proposed and can be found on page 53. The antenna proposed is compliant with specifications outlined in RFQ except as follows:

3.1.1.1.3.4 The preliminary weight of the antenna proposed is 5,495 pounds.

3.1.1.1.3.5 The Effective Projected Area (EPA) for the antenna proposed is 73.9-square feet (6.9-square meters). This is based on an antenna design wind speed of 90 miles per hour with no ice and 30 miles per hour with 0.75-inches of design

radial ice (2.23-inches of factored ice at the antenna, tiz) with a height above ground level of 450-feet per ANSI/TIA222-G. Structure Class II, Exposure Category C, Topographic Category III and a Crest Height of 1000-feet. The Weight and Wind Area Values include the four (4) lightning spurs at the top of the antenna and a standard beacon (customer supplied).

3.1.1.2.1 The TRASAR UHF television antenna proposed is elliptically polarized and as specified provide sufficient gain for the vertically polarized component to provide an effective radiated power (ERP) for the vertical polarization of 30%, relative to the ERP of the horizontal polarization.

3.1.1.3.1 The antenna proposed has input power rating of 30 kW average power at RF Channel 34 (593 MHz). The 6-1/8-inch, 75-ohm, rigid transmission line proposed has an average power handling capability of 60 kW and an attenuation of 0.111/dB per 100-feet at RF Channel 34 (593 MHz).

6.1 ERI can supply the equipment offered in the 120 day time period specified however Sections 42 and 43 of the General Terms and Conditions identify a Preference for Use of Domestic Steel. To provide the antenna azimuth pattern specified in the FCC application calls for the use of 10.75-inch OD galvanized steel pipe. The wind and ice parameters for this location and the Crest Height of the site, per TIA-222-G, dictate that this top mounted antenna be made from high strength 65 ksi steel. This type of material is only readily available to ERI from European mills and to allow ERI to achieve the shorter delivery cycles required by the FCC Repack we have dedicated stock of this material in house or at our supplier warehouses. If awarded this contract the antenna would be made for pipe produced at a German steel mill.

That is the extent of deviations ERI believes are included in our offer.

Respectfully submitted,

ELECTRONICS RESEARCH, INC.

Bill Harland
Vice President of Marketing
August 13, 2019

ERI Bid Support Information Contents

ERI Company and Product Information

Primary Business and Services

Electronics Research, Inc. is a company focused on serving the needs of the terrestrial radio and television broadcasters with antennas, transmission line, RF components, and structural products. The company is focused on providing high quality and sophisticated engineering solutions to customer problems. ERI Products and Services include:

- UHF and VHF Television Broadcast Antennas
- Single and Multi-Station FM Broadcast Antennas
- Television and FM Broadcast Filters and Combiners
- Rigid Coaxial Transmission Line
- Rectangular and Circular Waveguide
- Broadcast Master Distributor for CommScope HELIAX®[1] products and accessories
- Structural products:
    - Guyed towers
    - Self-supporting towers
    - Antenna support poles
    - Specialty structures
    - Lambda™ Antenna Mounting System
    - Grounding and lightning protection products
    - Gin Poles
- Structural services:
    - Site inspection services
    - Tower installation
    - Tower rescue services
    - Structural analysis services
    - Engineering field support
    - Antenna test range facilities
    - Tower field service
    - Tower reinforcement design and installation services

History and Qualifications

Electronics Research, Inc. (ERI) is a company that has provided state-of-the-art telecommunications and broadcast products since 1943. ERI's products and services include television and FM antennas; RF filters and combiners; self-supporting and guyed towers; grounding and lightning protection products; installation, maintenance, structural analysis and inspection services; rigid coaxial transmission line and UHF waveguide transmission line systems. ERI is also the Broadcast Master Distributor for CommScope HELIAX, HELIAX accessories, pressurization products, and terrestrial microwave products.

ERI is the originator of many of the commonly used technologies for FM transmission today, including internally fed circularly polarized FM antennas, and temperature compensated RF filters. The company produces a broad array of single station and broadband FM antenna designs provide superior reliability and performance for any reasonable application. ERI also manufactures a wide array of filter products that can be configured to eliminate undesirable intermodulation products and are used as combining systems for master FM antennas.

[1] HELIAX® is registered trademark of CommScope.

In November 2003, ERI completed the acquisition of selected assets that comprised Andrew Corporation's (now CommScope) television broadcast antenna business. The acquisition included Andrew's MACXLine and GUIDELine transmission line products and the company's complete line of television transmitting antennas and Andrew's television filter and RF components business which includes waveguide and coaxial switches, patch panels, directional couplers, and the other components required to produce a wide array of filter and combiner system for broadcast and scientific applications. In addition, to purchasing these assets ERI also entered into an agreement to serve as a CommScope Master Distributor of HELIAX products and accessories to the broadcast market.

ERI has 205 employees, including two (2) registered professional engineers. ERI's corporate headquarters and main manufacturing facility is located in Chandler, Indiana. Our Midwest location provides the benefit of the most convenient, cost effective, product transportation to any part of North America. The ERI facility is located on 100 acres and includes a total of more than 250,000 square feet of indoor manufacturing space. Near the main factory complex is ERI's 50-acre test range, capable of full-scale antenna/tower pattern measurements. The company has decades of research and experience at full scale testing and the company's unique blend of individual educated and trained in antenna and structural design result in systems that offer superior performance and reliability. The test range is equipped with the latest in computerized test equipment and also has the latest computer software to measure and predict antenna performance and radiated pattern.

The company takes full advantage of innovative technology, which includes the latest computer modeling, design, and drafting tools; as well as the latest computer-controlled machining and milling equipment. ERI's main manufacturing facility also includes an advanced acid cleaning facility and an in-house silver-plating operation. This high degree of vertical integration allows control of product quality at every step during fabrication and final assembly.

ERI's Headquarters and Manufacturing Facility.

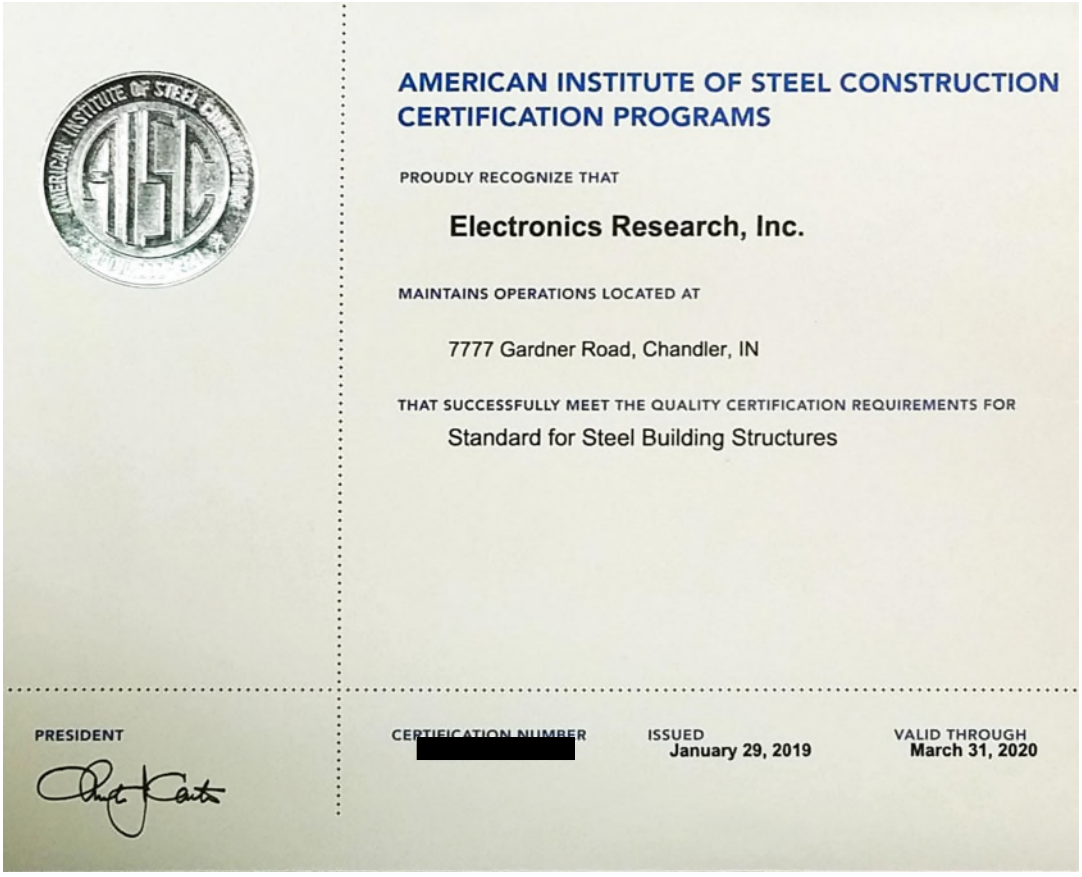
ERI began manufacturing towers and providing structural analysis services in 1990. We manufacture guyed and self-supporting towers. ERI also has registered structural engineers on staff to provide structural analysis and reinforcement design services to tower owners. ERI has manufactured and installed towers ranging in height from less than 100-feet to 2000-feet. The

structural division of ERI also provides a complete line of grounding and lightning protection products.

Electronics Research, Inc. is officially certified under the Steel Building Standard of the American Institute of Steel Construction (AISC). This designation reaffirms ERI's dedication to the quality-control process and our on-going effort to ensure our customers receive the highest quality structural systems.

The company maintains two fulltime tower crews each with a full set of equipment, trucks, and winches. All tower crews undergo rigorous safety training and the company's training regime is considered one of the industry's best. The company also maintains a separate crew that focuses and tower inspections. The company is compliant with all current OSHA regulations, maintains liability and workmen's compensation insurance at or above minimum requirement levels and can provide performance and payment bonds, for specific projects if required.

ERI has continuously served the broadcast industry with a dedicated team of engineering professionals, supported by experienced and meticulous craftsman for product fabrication and dedicated project management to insure on time and on budget project delivery, installation, and commissioning.



AMERICAN INSTITUTE OF STEEL CONSTRUCTION
CERTIFICATION PROGRAMS

PROUDLY RECOGNIZE THAT

Electronics Research, Inc.

MAINTAINS OPERATIONS LOCATED AT

7777 Gardner Road, Chandler, IN

THAT SUCCESSFULLY MEET THE QUALITY CERTIFICATION REQUIREMENTS FOR

Standard for Steel Building Structures

PRESIDENT

CERTIFICATION NUMBER [redacted]

ISSUED January 29, 2019

VALID THROUGH March 31, 2020

ERI's current AISC certification

TRASAR Antenna Preliminary Specifications

ERI Model ATW21H4-ETC170-34H

Preliminary Specification for
TRASAR® Top Mounted
UHF Elliptically Polarized
Coaxial Slotted Array Television Antenna

WNPB-TV, RF Channel 34

WV Educational Broadcasting Authority, Morgantown, WV

August 11, 2019

Antenna Model:
ATW21H4-ETC170-34H

Specification Number
20190810-396

Electronics Research, Inc. 7777 Gardner Road Chandler IN 47610-9219 USA
+1 812 925-6000 (tel) +1 812 925-4030 (fax)

Preliminary Specification for TRASAR® Top Mounted UHF Elliptically Polarized Coaxial Slotted Array Television Antenna

Electrical Characteristics:

Channel:		34	
Frequency:		590 MHz to 596 MHz	
Service:		ATSC	
Azimuth Pattern Number:	Horizontal Polarization	C170	
	Vertical Polarization	ATW-WC-V	
Elevation Pattern Number:	Horizontal Polarization	ATW21H4H	
	Vertical Polarization	ATW18H4H	
Azimuth Directivity:	Horizontal Polarization	1.70	(2.30 dB)
	Vertical Polarization	1.95	(2.89 dB)
Elevation Directivity:	Horizontal Polarization	21.00	(13.22 dBd)
	Vertical Polarization	18.00	(12.55 dBd)
Peak Power Gain:	Horizontal Polarization	27.34	(14.37 dBd)
	Vertical Polarization	8.20	(9.14 dBd)
Gain at Horizontal:	Horizontal Polarization	16.21	(12.10 dBd)
	Vertical Polarization	4.89	(6.89 dBd)
ERP Vertical/Horizontal Ratio:		0.300	
Power Ratio:		0.306	
Electrical Beam Tilt:		1.00 Degrees	
Input Power Required:		24.14 kW	(13.83 dBk)
RF Input:		6-1/8-inch EIA, 75 Ω, flanged male	
Input Power Rating (maximum):		48 kW Average Power, 8VSB	
Antenna VSWR (maximum):		1.10 Over 6 MHz Channel	

Preliminary Specification for TRASAR® Top Mounted

Coaxial Slotted Array Television Antenna

Antenna Mechanical Characteristics:

Mounting Configuration:		Top Mounted	
Height of Antenna (D):		41.0 feet	(12.5 meters)
"Height of Center of Radiation (B):		20.5 feet	(6.3 meters)
Overall Height (Includes four 3.5 ft lightning spurs) (A):		44.5 feet	(13.6 meters)
Deicing:		Fully enclosed pressurized radome	
Radome Diameter (C):		TBD	
Radome Color:		Aviation Orange	
Climbing Device:		Galvanized Steel Climbing Pole	
Calculated Weight[1]:	No Ice	5495.0 lb	2492.5 kg
	1/2" (13 mm) ice	6415.0 lb	2909.8 kg
Effective Projected Area (EPA-ft^2)[1 2]:			
	No Ice	73.9 ft²	(6.9 m²)
	1/2" (13 mm) ice	137.8 ft²	(12.8 m²)
Effective Moment Arm[1 2]:	No Ice	22.00 feet	(6.71 meters)
	1/2" (13 mm) ice	21.70 feet	(6.62 meters)

MOUNTING FLANGE BOLT CIRCLE[3]: Quantity (16), 1.25 inch holes for 1.125 inch x 6.5 inch bolts, equally spaced on a 15.25 inch bolt circle.

This antenna is designed to be supported by a structure that can resist the antenna base reactions and which provides a support that is rigid in the three translational and three rotational degrees of freedom.

1) Please note, the listed weights and effective wind areas are based on the PRELIMINARY design of the antenna. Final As-Built values for the antenna are typically within +/-10% of the Preliminary design values, and will be provided in the technical manual that accompanies the antenna. Specified loads include the antenna, lightning spurs, and beacon only. Custom mounting brackets/adapters and/or antenna input section are NOT included.

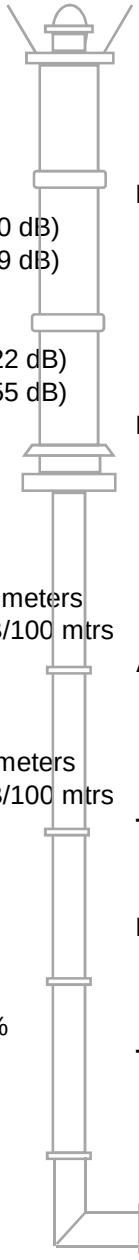
2) Preliminary antenna design based on a wind speed of 90 miles per hour (MPH) with no ice and 30 MPH with 0.75-inches of design radial ice (2.232-inches of factored ice at antenna, tiz) with a height above ground level (HAGL) of 450 feet per ANSI/TIA-222-G. Structure Class II, Exposure Category C and Topographic Category I. Weight and wind area values include four lightning spurs and a standard beacon.

3) The mounting flange specified matches the mounting flange used for the current WNPB-TV antenna. Information based on drawing included in Addendum 1 of CRFQ EBA2000000004 issued August 09, 2019. Customer shall be responsible for supplying existing flange bolt pattern details when requesting a custom matching flange on the new antenna.

NOTE: The purchaser or their representative shall be required to contact the tower owner, state and/or local building officials for specific design requirements and suitable parameters for a particular structure. Any variation from the parameters shown above must be communicated to ERI for comprehensive assessment.

Broadcast Antenna System
Power Analysis

WNPB-TV RF Channel: 34
WV Educational Broadcasting Authority
Morgantown, WV
ATW21H4-ETC170-34H



Antenna Parameters

Azimuth Directivity:

Horizontal:	1.70	(2.30 dB)
Vertical:	1.95	(2.89 dB)

Elevation Directivity:

Horizontal:	21.00	(13.22 dB)
Vertical:	18.00	(12.55 dB)

Transmission Line

Vertical Run:

Type:	6-1/8-inch EIA, 75 Ω	
Length:	440 feet	134.1 meters
Attenuation:	0.111 dB/100 feet	0.364 dB/100 mtrs

Horizontal Run:

Type:	6-1/8-inch EIA, 75 Ω	
Length:	132 feet	40.2 meters
Attenuation:	0.111 dB/100 feet	0.364 dB/100 mtrs

Transmission Line Efficiency: 86.40%

RF System/Other Efficiency: 100.00%

Effective Radiated Power:

Horizontal:	660.00 kW	(28.20 dBk)
Vertical:	198.00 kW	(22.97 dBk)

Peak Power Gain:

Horizontal:	27.34 numeric	(14.37 dBd)
Vertical:	8.20 numeric	(9.14 dBd)

Antenna Input Power:
24.14 kW (13.83 dBk)

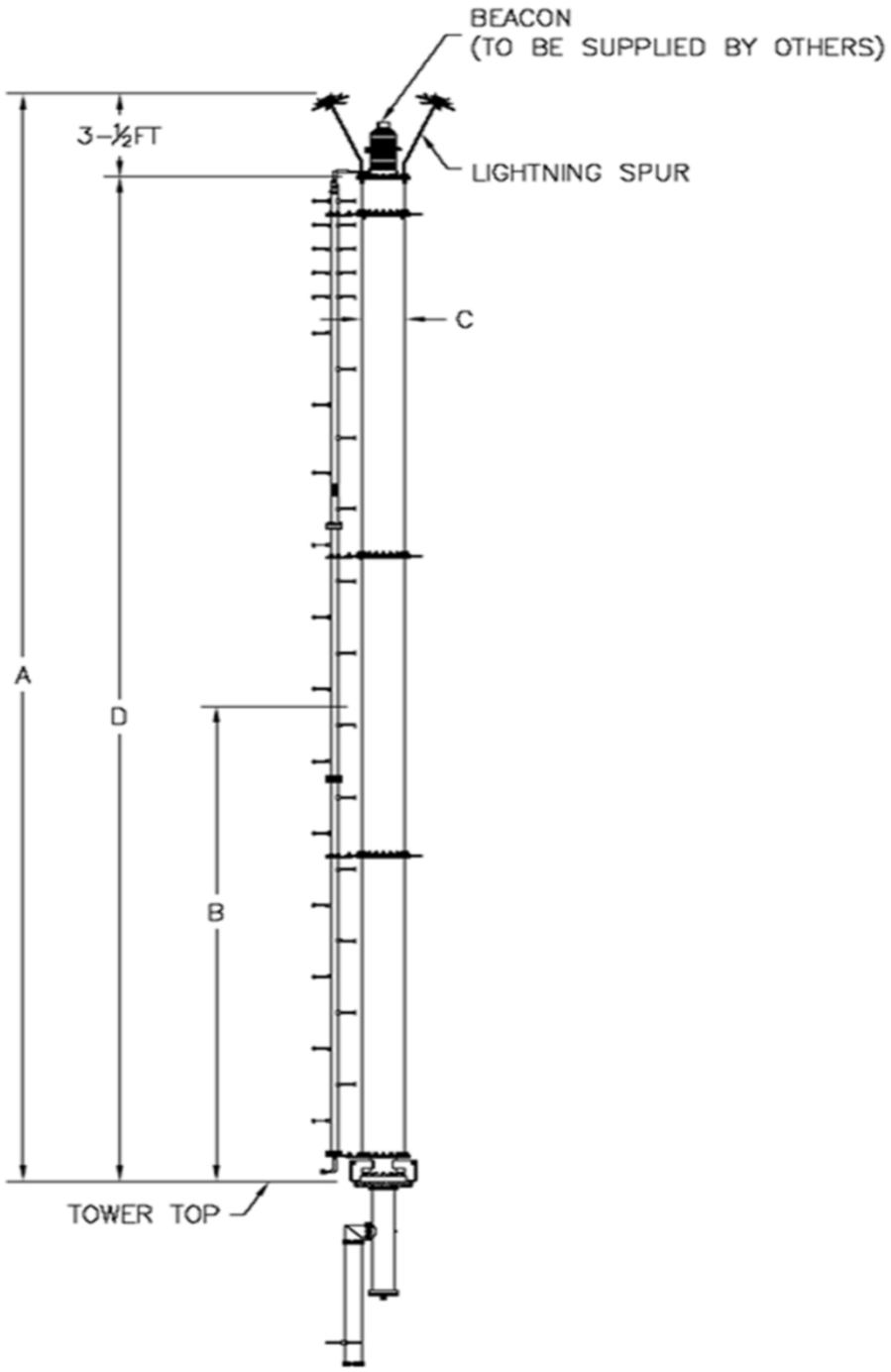
Transmission Line Losses:
-3.80 kW (0.635 dB)

RF System/Other Losses:
0.00 kW (0.000 dB)

Total Losses:
-3.80 kW (0.635 dB)

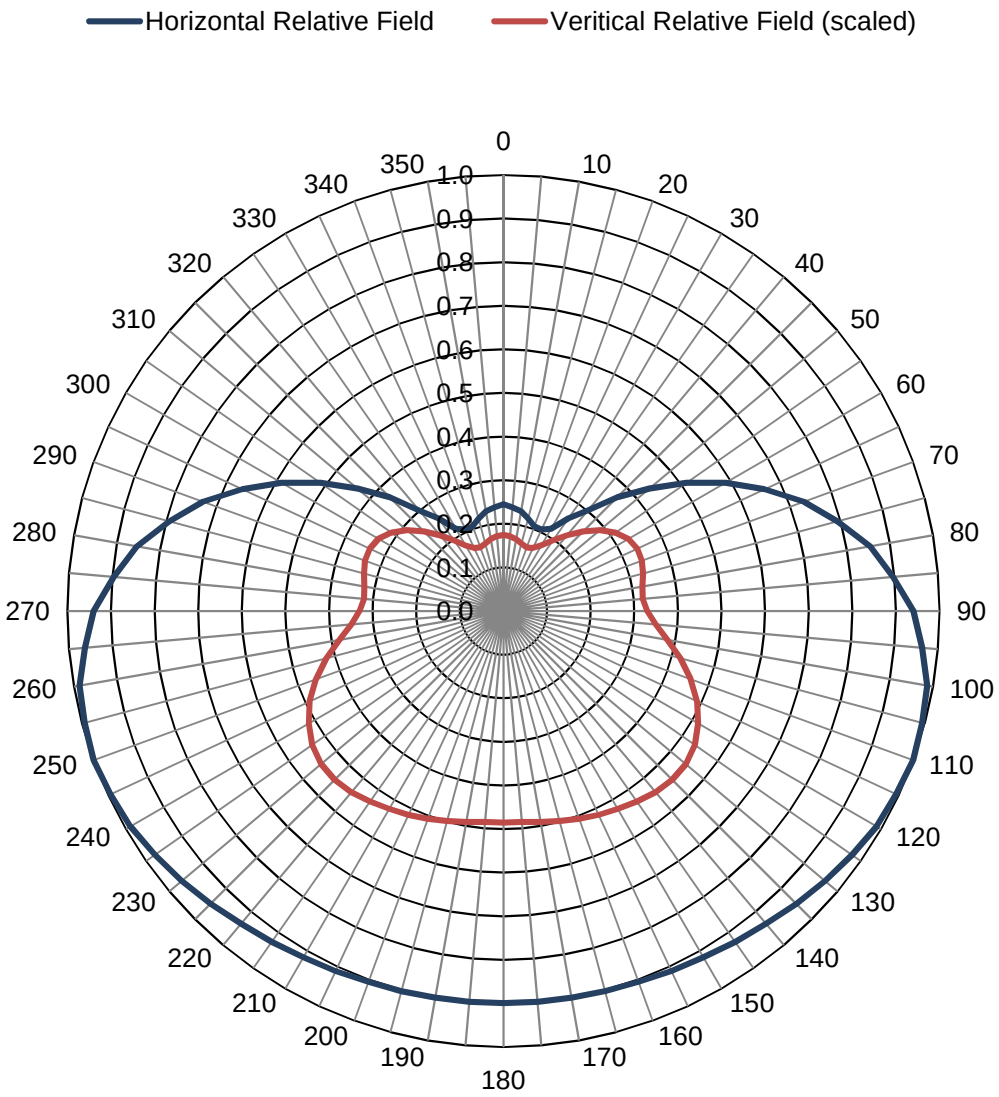
Transmitter Power Output:
27.94 kW
(14.46 dBk)

Typical Mounting Configuration Shown. Actual Configuration May Vary.



Composite Azimuth Patterns

Type:	C170		**Polarization:**	Elliptical
Directivity (H-Pol):	1.70 numeric	(2.30 dB)	**Frequency:**	34 (ATSC)
Directivity (V-Pol):	1.95 numeric	(2.89 dB)	**Location:**	Morgantown, WV
Percent Horizontal:	76.59%		NOTE: Pattern shape and directivity may vary with channel and mounting	
Percent Vertical:	23.41%			
Power Ratio:	30.56%			
ERP V/H Ratio::	30.00%			

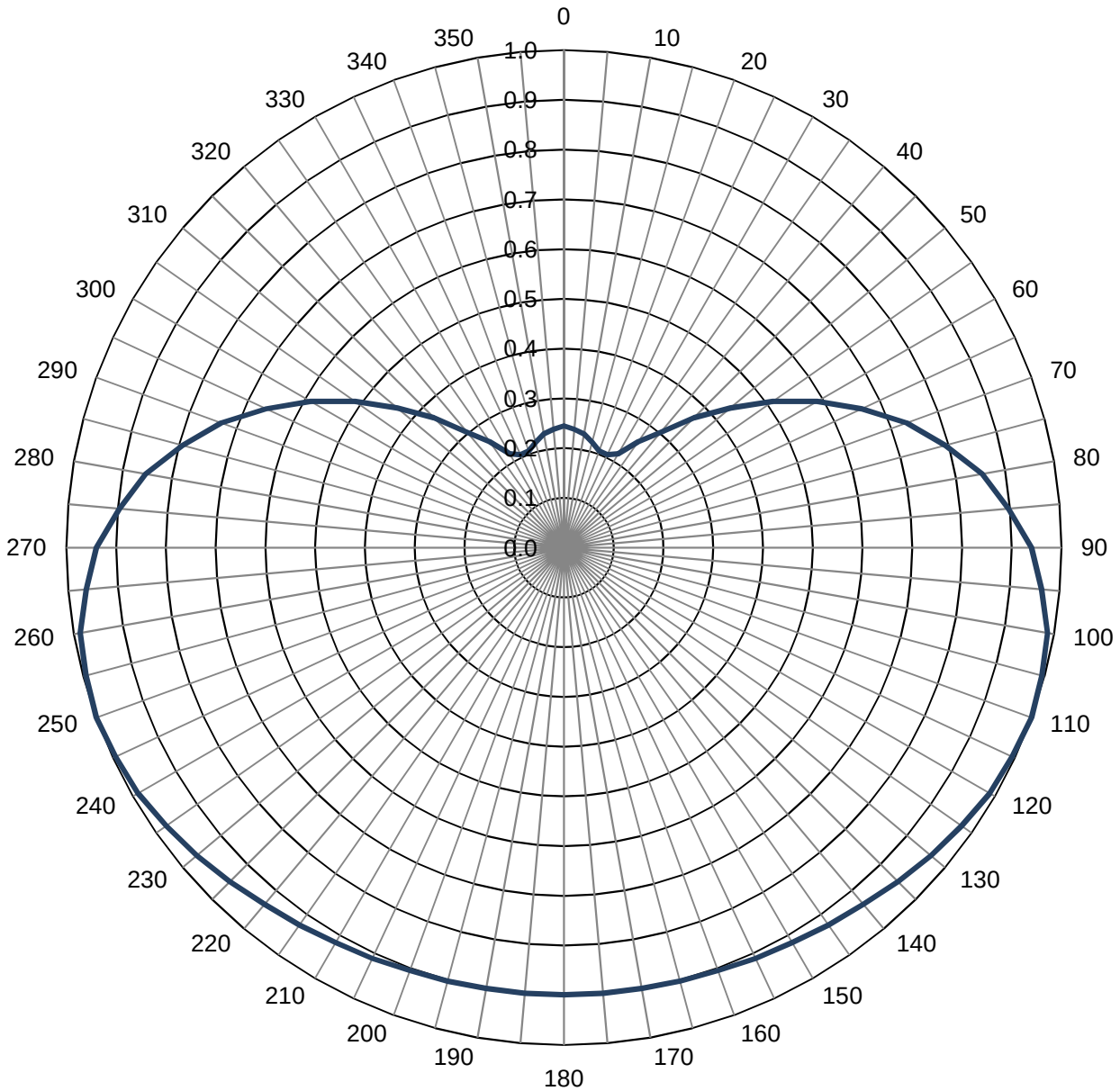


Azimuth Pattern

Type:	C170		**Polarization:**	Horizontal
Directivity:	1.70 numeric	(2.30 dB)	**Frequency:**	34 (ATSC)
Peak(s) at:			**Location:**	Morgantown, WV

NOTE: Pattern shape and directivity may vary with channel and mounting configuration.

Relative Field



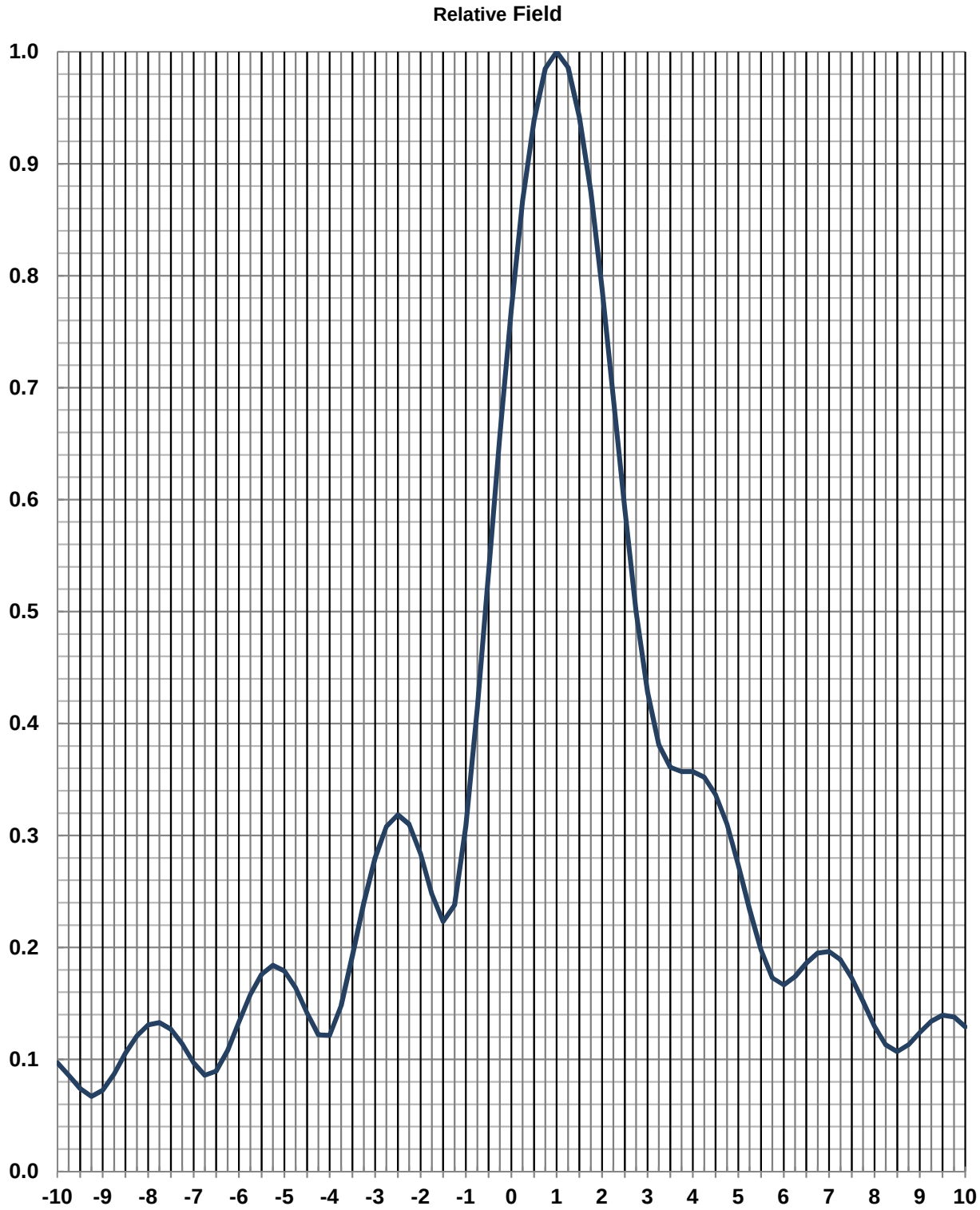
Tabulated Data for Azimuth Pattern

Type: C170

Angle	Field	dB
0	0.245	-12.22
2	0.242	-12.31
4	0.240	-12.40
6	0.237	-12.50
8	0.235	-12.59
10	0.232	-12.69
12	0.227	-12.88
14	0.222	-13.07
16	0.217	-13.27
18	0.212	-13.47
20	0.207	-13.68
22	0.206	-13.74
24	0.204	-13.81
26	0.209	-13.61
28	0.213	-13.42
30	0.218	-13.23
32	0.235	-12.59
34	0.252	-11.99
36	0.268	-11.42
38	0.285	-10.90
40	0.302	-10.40
42	0.329	-9.66
44	0.356	-8.97
46	0.383	-8.34
48	0.410	-7.74
50	0.437	-7.19
52	0.467	-6.61
54	0.497	-6.07
56	0.528	-5.55
58	0.558	-5.07
60	0.588	-4.61
62	0.617	-4.19
64	0.646	-3.80
66	0.675	-3.41
68	0.704	-3.05
70	0.733	-2.70
72	0.757	-2.42
74	0.781	-2.14
76	0.806	-1.88
78	0.830	-1.62
80	0.854	-1.37
82	0.871	-1.20
84	0.888	-1.03
86	0.906	-0.86
88	0.923	-0.70
90	0.940	-0.54
92	0.949	-0.45
94	0.959	-0.37
96	0.968	-0.28
98	0.978	-0.20
100	0.987	-0.11
102	0.990	-0.09
104	0.993	-0.06
106	0.996	-0.04
108	0.999	-0.01
110	1.000	0.00
112	0.998	-0.02
114	0.995	-0.04
116	0.993	-0.06
118	0.990	-0.08
120	0.988	-0.10
122	0.983	-0.15
124	0.978	-0.19
126	0.973	-0.24
128	0.968	-0.28
130	0.963	-0.33
132	0.958	-0.38
134	0.952	-0.43
136	0.947	-0.47
138	0.941	-0.52
140	0.936	-0.57
142	0.932	-0.61
144	0.928	-0.65
146	0.925	-0.68
148	0.921	-0.72
150	0.917	-0.75
152	0.915	-0.78
154	0.912	-0.80
156	0.910	-0.82
158	0.907	-0.84
160	0.905	-0.87
162	0.904	-0.88
164	0.903	-0.89
166	0.902	-0.90
168	0.901	-0.91
170	0.900	-0.92
172	0.900	-0.92
174	0.900	-0.92
176	0.899	-0.92
178	0.899	-0.92
180	0.899	-0.92
182	0.899	-0.92
184	0.899	-0.92
186	0.900	-0.92
188	0.900	-0.92
190	0.900	-0.92
192	0.901	-0.91
194	0.902	-0.90
196	0.903	-0.89
198	0.904	-0.88
200	0.905	-0.87
202	0.907	-0.84
204	0.910	-0.82
206	0.912	-0.80
208	0.915	-0.78
210	0.917	-0.75
212	0.921	-0.72
214	0.925	-0.68
216	0.928	-0.65
218	0.932	-0.61
220	0.936	-0.57
222	0.941	-0.52
224	0.947	-0.47
226	0.952	-0.43
228	0.958	-0.38
230	0.963	-0.33
232	0.968	-0.28
234	0.973	-0.24
236	0.978	-0.19
238	0.983	-0.15
240	0.988	-0.10
242	0.990	-0.08
244	0.993	-0.06
246	0.995	-0.04
248	0.998	-0.02
250	1.000	0.00
252	0.999	-0.01
254	0.996	-0.04
256	0.993	-0.06
258	0.990	-0.09
260	0.987	-0.11
262	0.978	-0.20
264	0.968	-0.28
266	0.959	-0.37
268	0.949	-0.45
270	0.940	-0.54
272	0.923	-0.70
274	0.906	-0.86
276	0.888	-1.03
278	0.871	-1.20
280	0.854	-1.37
282	0.830	-1.62
284	0.806	-1.88
286	0.781	-2.14
288	0.757	-2.42
290	0.733	-2.70
292	0.704	-3.05
294	0.675	-3.41
296	0.646	-3.80
298	0.617	-4.19
300	0.588	-4.61
302	0.558	-5.07
304	0.528	-5.55
306	0.497	-6.07
308	0.467	-6.61
310	0.437	-7.19
312	0.410	-7.74
314	0.383	-8.34
316	0.356	-8.97
318	0.329	-9.66
320	0.302	-10.40
322	0.285	-10.90
324	0.268	-11.42
326	0.252	-11.99
328	0.235	-12.59
330	0.218	-13.23
332	0.213	-13.42
334	0.209	-13.61
336	0.204	-13.81
338	0.206	-13.74
340	0.207	-13.68
342	0.212	-13.47
344	0.217	-13.27
346	0.222	-13.07
348	0.227	-12.88
350	0.232	-12.69
352	0.235	-12.59
354	0.237	-12.50
356	0.240	-12.40
358	0.242	-12.31
360	0.245	-12.22

Elevation Pattern

Type:	ATW21H4H		**Polarization:**	Horizontal
Directivity:			**Frequency:**	34 (ATSC)
Main Lobe:	21.00 numeric	(13.22 dB)	**Location:**	Morgantown, WV
Horizontal:	12.45 numeric	(10.95 dB)	**Beam Tilt:**	1.00 degrees



Tabulated Data for Elevation Pattern

Type: ATW21H4H

-10 to 10 degrees in 0.25 degree increments.
10 to 90 degrees in 0.50 degree increments.

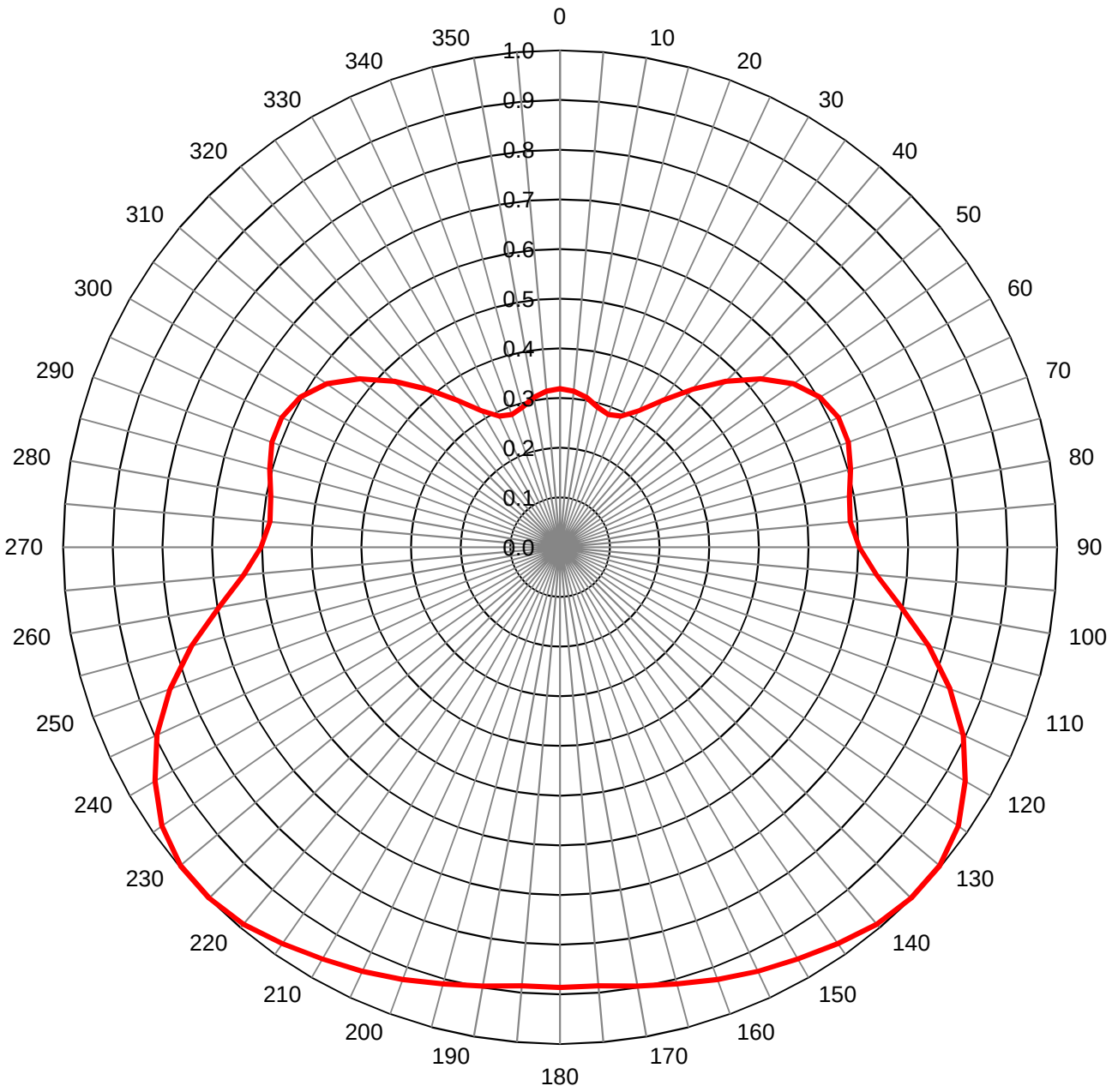
Angle	Field	dB	Angle	Field	dB	Angle	Field	dB	Angle	Field	dB	Angle	Field	dB
-10.00	0.097	-20.26	2.25	0.691	-3.21	19.00	0.047	-26.65	43.50	0.043	-27.33	68.00	0.051	-25.93
-9.75	0.086	-21.31	2.50	0.592	-4.56	19.50	0.059	-24.66	44.00	0.048	-26.47	68.50	0.043	-27.43
-9.50	0.074	-22.62	2.75	0.500	-6.02	20.00	0.068	-23.41	44.50	0.046	-26.84	69.00	0.034	-29.37
-9.25	0.067	-23.48	3.00	0.428	-7.37	20.50	0.063	-24.01	45.00	0.038	-28.40	69.50	0.026	-31.87
-9.00	0.073	-22.79	3.25	0.381	-8.38	21.00	0.050	-26.11	45.50	0.029	-30.90	70.00	0.022	-33.15
-8.75	0.087	-21.21	3.50	0.361	-8.85	21.50	0.040	-27.96	46.00	0.025	-32.04	70.50	0.025	-32.22
-8.50	0.106	-19.53	3.75	0.357	-8.95	22.00	0.048	-26.38	46.50	0.032	-29.90	71.00	0.032	-30.03
-8.25	0.121	-18.34	4.00	0.357	-8.95	22.50	0.059	-24.58	47.00	0.042	-27.54	71.50	0.040	-27.96
-8.00	0.131	-17.65	4.25	0.352	-9.07	23.00	0.061	-24.36	47.50	0.048	-26.47	72.00	0.048	-26.38
-7.75	0.133	-17.52	4.50	0.337	-9.46	23.50	0.051	-25.85	48.00	0.048	-26.47	72.50	0.055	-25.19
-7.50	0.127	-17.92	4.75	0.310	-10.17	24.00	0.039	-28.29	48.50	0.042	-27.54	73.00	0.061	-24.36
-7.25	0.114	-18.86	5.00	0.274	-11.24	24.50	0.039	-28.18	49.00	0.033	-29.63	73.50	0.065	-23.81
-7.00	0.097	-20.26	5.25	0.234	-12.62	25.00	0.050	-26.02	49.50	0.026	-31.87	74.00	0.067	-23.54
-6.75	0.086	-21.31	5.50	0.198	-14.07	25.50	0.057	-24.88	50.00	0.028	-31.21	74.50	0.067	-23.48
-6.50	0.090	-20.96	5.75	0.173	-15.24	26.00	0.053	-25.51	50.50	0.036	-28.87	75.00	0.066	-23.61
-6.25	0.108	-19.33	6.00	0.167	-15.57	26.50	0.042	-27.64	51.00	0.045	-26.94	75.50	0.064	-23.94
-6.00	0.134	-17.49	6.25	0.174	-15.19	27.00	0.034	-29.50	51.50	0.050	-26.02	76.00	0.060	-24.44
-5.75	0.158	-16.03	6.50	0.186	-14.61	27.50	0.040	-27.96	52.00	0.049	-26.29	76.50	0.056	-25.11
-5.50	0.176	-15.09	6.75	0.195	-14.20	28.00	0.050	-26.02	52.50	0.043	-27.33	77.00	0.051	-25.93
-5.25	0.184	-14.70	7.00	0.197	-14.13	28.50	0.054	-25.43	53.00	0.034	-29.37	77.50	0.045	-27.03
-5.00	0.179	-14.94	7.25	0.189	-14.47	29.00	0.047	-26.56	53.50	0.026	-31.87	78.00	0.039	-28.18
-4.75	0.164	-15.70	7.50	0.173	-15.24	29.50	0.036	-28.87	54.00	0.027	-31.54	78.50	0.034	-29.50
-4.50	0.142	-16.98	7.75	0.152	-16.36	30.00	0.032	-30.03	54.50	0.034	-29.37	79.00	0.028	-31.21
-4.25	0.122	-18.27	8.00	0.130	-17.75	30.50	0.040	-27.96	55.00	0.044	-27.13	79.50	0.024	-32.58
-4.00	0.122	-18.31	8.25	0.113	-18.94	31.00	0.049	-26.20	55.50	0.051	-25.93	80.00	0.020	-34.20
-3.75	0.148	-16.59	8.50	0.107	-19.41	31.50	0.051	-25.93	56.00	0.053	-25.51	80.50	0.017	-35.39
-3.50	0.193	-14.31	8.75	0.113	-18.94	32.00	0.043	-27.33	56.50	0.050	-26.11	81.00	0.016	-35.92
-3.25	0.240	-12.40	9.00	0.124	-18.13	32.50	0.032	-29.90	57.00	0.043	-27.33	81.50	0.017	-35.65
-3.00	0.280	-11.06	9.25	0.134	-17.46	33.00	0.030	-30.60	57.50	0.034	-29.37	82.00	0.018	-34.89
-2.75	0.308	-10.23	9.50	0.140	-17.11	33.50	0.039	-28.18	58.00	0.027	-31.54	82.50	0.019	-34.42
-2.50	0.319	-9.94	9.75	0.138	-17.20	34.00	0.048	-26.47	58.50	0.026	-31.87	83.00	0.021	-33.76
-2.25	0.310	-10.17	10.00	0.129	-17.79	34.50	0.049	-26.29	59.00	0.033	-29.63	83.50	0.022	-33.35
-2.00	0.284	-10.95	10.50	0.099	-20.09	35.00	0.042	-27.54	59.50	0.043	-27.33	84.00	0.022	-33.15
-1.75	0.248	-12.11	11.00	0.079	-22.05	35.50	0.031	-30.17	60.00	0.051	-25.93	84.50	0.022	-33.15
-1.50	0.223	-13.03	11.50	0.091	-20.82	36.00	0.028	-31.21	60.50	0.056	-25.11	85.00	0.022	-33.15
-1.25	0.238	-12.47	12.00	0.107	-19.41	36.50	0.036	-28.87	61.00	0.056	-25.04	85.50	0.022	-33.35
-1.00	0.309	-10.21	12.50	0.104	-19.70	37.00	0.045	-27.03	61.50	0.053	-25.60	86.00	0.021	-33.76
-0.75	0.414	-7.66	13.00	0.083	-21.67	37.50	0.048	-26.38	62.00	0.046	-26.74	86.50	0.019	-34.42
-0.50	0.535	-5.43	13.50	0.064	-23.94	38.00	0.043	-27.33	62.50	0.037	-28.64	87.00	0.017	-35.39
-0.25	0.657	-3.65	14.00	0.071	-23.04	38.50	0.033	-29.63	63.00	0.029	-30.90	87.50	0.015	-36.48
0.00	0.770	-2.27	14.50	0.086	-21.31	39.00	0.026	-31.70	63.50	0.024	-32.40	88.00	0.013	-38.06
0.25	0.867	-1.24	15.00	0.088	-21.16	39.50	0.031	-30.17	64.00	0.028	-31.21	88.50	0.010	-40.00
0.50	0.939	-0.55	15.50	0.072	-22.85	40.00	0.041	-27.74	64.50	0.036	-28.87	89.00	0.008	-42.50
0.75	0.985	-0.13	16.00	0.055	-25.19	40.50	0.047	-26.56	65.00	0.046	-26.74	89.50	0.005	-46.94
1.00	1.000	0.00	16.50	0.057	-24.96	41.00	0.047	-26.65	65.50	0.054	-25.43	90.00	0.002	-56.48
1.25	0.986	-0.12	17.00	0.071	-22.97	41.50	0.039	-28.18	66.00	0.059	-24.66			
1.50	0.942	-0.52	17.50	0.077	-22.33	42.00	0.029	-30.75	66.50	0.061	-24.29			
1.75	0.875	-1.16	18.00	0.068	-23.41	42.50	0.026	-31.87	67.00	0.060	-24.44			
2.00	0.789	-2.06	18.50	0.051	-25.93	43.00	0.033	-29.63	67.50	0.057	-24.96			

Azimuth Pattern

Type:	ATW-WC-V		**Polarization:**	Vertical
Directivity:	1.95 numeric	(2.89 dB)	**Frequency:**	34 (ATSC)
Peak(s) at:			**Location:**	Morgantown, WV

NOTE: Pattern shape and directivity may vary with channel and mounting configuration.

Relative Field



Tabulated Data for Azimuth Pattern

Type: ATW-WC-V

Angle	Field	dB
0	0.319	-9.92
2	0.319	-9.92
4	0.316	-10.01
6	0.314	-10.06
8	0.309	-10.20
10	0.306	-10.29
12	0.301	-10.43
14	0.294	-10.63
16	0.290	-10.75
18	0.286	-10.87
20	0.284	-10.93
22	0.285	-10.90
24	0.289	-10.78
26	0.294	-10.63
28	0.304	-10.34
30	0.317	-9.98
32	0.333	-9.55
34	0.349	-9.14
36	0.369	-8.66
38	0.392	-8.13
40	0.415	-7.64
42	0.439	-7.15
44	0.462	-6.71
46	0.485	-6.29
48	0.506	-5.92
50	0.527	-5.56
52	0.547	-5.24
54	0.565	-4.96
56	0.581	-4.72
58	0.594	-4.52
60	0.604	-4.38
62	0.613	-4.25
64	0.618	-4.18
66	0.619	-4.17
68	0.619	-4.17
70	0.617	-4.19
72	0.613	-4.25
74	0.609	-4.31
76	0.602	-4.41
78	0.596	-4.50
80	0.591	-4.57
82	0.588	-4.61
84	0.586	-4.64
86	0.587	-4.63
88	0.593	-4.54
90	0.602	-4.41
92	0.613	-4.25
94	0.629	-4.03
96	0.650	-3.74
98	0.673	-3.44

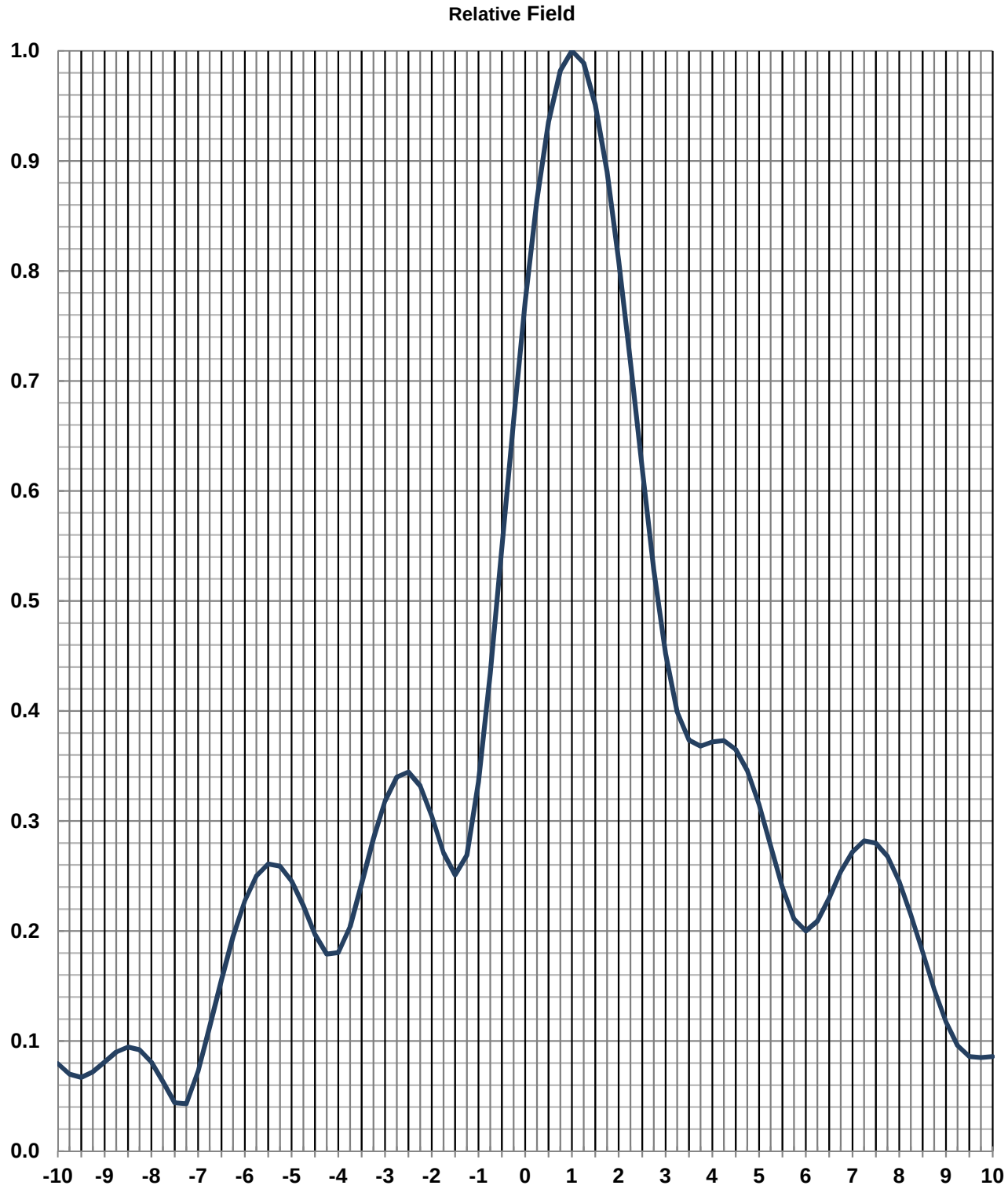
Angle	Field	dB
100	0.697	-3.14
102	0.724	-2.81
104	0.753	-2.46
106	0.782	-2.14
108	0.808	-1.85
110	0.835	-1.57
112	0.859	-1.32
114	0.885	-1.06
116	0.906	-0.86
118	0.926	-0.67
120	0.941	-0.53
122	0.959	-0.36
124	0.971	-0.26
126	0.981	-0.17
128	0.991	-0.08
130	0.997	-0.03
132	0.999	-0.01
134	0.999	-0.01
136	0.999	-0.01
138	0.995	-0.04
140	0.991	-0.08
142	0.985	-0.13
144	0.979	-0.18
146	0.971	-0.26
148	0.964	-0.32
150	0.957	-0.38
152	0.950	-0.45
154	0.944	-0.50
156	0.937	-0.57
158	0.931	-0.62
160	0.926	-0.67
162	0.919	-0.73
164	0.913	-0.79
166	0.907	-0.85
168	0.902	-0.90
170	0.897	-0.94
172	0.891	-1.00
174	0.888	-1.03
176	0.886	-1.05
178	0.885	-1.06
180	0.886	-1.05
182	0.885	-1.06
184	0.886	-1.05
186	0.888	-1.03
188	0.891	-1.00
190	0.897	-0.94
192	0.902	-0.90
194	0.907	-0.85
196	0.913	-0.79
198	0.919	-0.73

Angle	Field	dB
200	0.926	-0.67
202	0.931	-0.62
204	0.937	-0.57
206	0.944	-0.50
208	0.950	-0.45
210	0.957	-0.38
212	0.964	-0.32
214	0.971	-0.26
216	0.979	-0.18
218	0.985	-0.13
220	0.991	-0.08
222	0.995	-0.04
224	0.999	-0.01
226	0.999	-0.01
228	0.999	-0.01
230	0.997	-0.03
232	0.991	-0.08
234	0.981	-0.17
236	0.971	-0.26
238	0.959	-0.36
240	0.941	-0.53
242	0.926	-0.67
244	0.906	-0.86
246	0.885	-1.06
248	0.859	-1.32
250	0.835	-1.57
252	0.808	-1.85
254	0.782	-2.14
256	0.753	-2.46
258	0.724	-2.81
260	0.697	-3.14
262	0.673	-3.44
264	0.650	-3.74
266	0.629	-4.03
268	0.613	-4.25
270	0.602	-4.41
272	0.593	-4.54
274	0.587	-4.63
276	0.586	-4.64
278	0.588	-4.61
280	0.591	-4.57
282	0.596	-4.50
284	0.602	-4.41
286	0.609	-4.31
288	0.613	-4.25
290	0.617	-4.19
292	0.619	-4.17
294	0.619	-4.17
296	0.618	-4.18
298	0.613	-4.25

Angle	Field	dB
300	0.604	-4.38
302	0.594	-4.52
304	0.581	-4.72
306	0.565	-4.96
308	0.547	-5.24
310	0.527	-5.56
312	0.506	-5.92
314	0.485	-6.29
316	0.462	-6.71
318	0.439	-7.15
320	0.415	-7.64
322	0.392	-8.13
324	0.369	-8.66
326	0.349	-9.14
328	0.333	-9.55
330	0.317	-9.98
332	0.304	-10.34
334	0.294	-10.63
336	0.289	-10.78
338	0.285	-10.90
340	0.284	-10.93
342	0.286	-10.87
344	0.290	-10.75
346	0.294	-10.63
348	0.301	-10.43
350	0.306	-10.29
352	0.309	-10.20
354	0.314	-10.06
356	0.316	-10.01
358	0.319	-9.92
360	0.319	-9.92

Elevation Pattern

Type:	ATW18H4H		**Polarization:**	Vertical
Directivity:			**Frequency:**	34 (ATSC)
Main Lobe:	18.00 numeric	(12.55 dB)	**Location:**	Morgantown, WV
Horizontal:	10.73 numeric	(10.31 dB)	**Beam Tilt:**	1.00 degrees



Tabulated Data for Elevation Pattern

Type: ATW18H4H

-10 to 10 degrees in 0.25 degree increments.
10 to 90 degrees in 0.50 degree increments.

Angle	Field	dB	Angle	Field	dB	Angle	Field	dB	Angle	Field	dB	Angle	Field	dB
-10.00	0.080	-21.99	2.25	0.717	-2.89	19.00	0.039	-28.18	43.50	0.070	-23.16	68.00	0.066	-23.68
-9.75	0.070	-23.10	2.50	0.620	-4.15	19.50	0.029	-30.75	44.00	0.055	-25.27	68.50	0.058	-24.73
-9.50	0.067	-23.48	2.75	0.528	-5.55	20.00	0.028	-31.06	44.50	0.038	-28.52	69.00	0.051	-25.93
-9.25	0.072	-22.85	3.00	0.452	-6.90	20.50	0.043	-27.43	45.00	0.025	-32.22	69.50	0.045	-26.94
-9.00	0.081	-21.83	3.25	0.399	-7.98	21.00	0.056	-25.04	45.50	0.026	-31.70	70.00	0.043	-27.33
-8.75	0.090	-20.92	3.50	0.374	-8.55	21.50	0.068	-23.41	46.00	0.035	-29.12	70.50	0.045	-27.03
-8.50	0.095	-20.49	3.75	0.368	-8.68	22.00	0.082	-21.78	46.50	0.041	-27.74	71.00	0.049	-26.29
-8.25	0.092	-20.72	4.00	0.372	-8.59	22.50	0.101	-19.91	47.00	0.041	-27.85	71.50	0.055	-25.27
-8.00	0.081	-21.83	4.25	0.373	-8.57	23.00	0.121	-18.38	47.50	0.034	-29.50	72.00	0.061	-24.36
-7.75	0.063	-24.01	4.50	0.365	-8.75	23.50	0.133	-17.52	48.00	0.021	-33.76	72.50	0.066	-23.68
-7.50	0.044	-27.13	4.75	0.346	-9.22	24.00	0.132	-17.59	48.50	0.008	-41.94	73.00	0.070	-23.16
-7.25	0.043	-27.33	5.00	0.315	-10.03	24.50	0.115	-18.82	49.00	0.021	-33.56	73.50	0.073	-22.79
-7.00	0.073	-22.79	5.25	0.278	-11.12	25.00	0.086	-21.36	49.50	0.040	-27.96	74.00	0.074	-22.62
-6.75	0.113	-18.94	5.50	0.240	-12.40	25.50	0.050	-26.11	50.00	0.057	-24.96	74.50	0.073	-22.73
-6.50	0.156	-16.17	5.75	0.211	-13.51	26.00	0.020	-34.20	50.50	0.069	-23.22	75.00	0.072	-22.85
-6.25	0.195	-14.20	6.00	0.200	-13.98	26.50	0.024	-32.58	51.00	0.076	-22.38	75.50	0.069	-23.22
-6.00	0.228	-12.86	6.25	0.209	-13.60	27.00	0.036	-29.00	51.50	0.078	-22.16	76.00	0.066	-23.68
-5.75	0.250	-12.04	6.50	0.230	-12.77	27.50	0.035	-29.24	52.00	0.076	-22.44	76.50	0.061	-24.36
-5.50	0.261	-11.67	6.75	0.254	-11.90	28.00	0.022	-33.35	52.50	0.072	-22.91	77.00	0.056	-25.11
-5.25	0.259	-11.73	7.00	0.272	-11.31	28.50	0.005	-46.02	53.00	0.068	-23.35	77.50	0.050	-26.11
-5.00	0.246	-12.20	7.25	0.282	-11.00	29.00	0.025	-32.04	53.50	0.066	-23.61	78.00	0.045	-27.03
-4.75	0.223	-13.03	7.50	0.280	-11.06	29.50	0.047	-26.65	54.00	0.067	-23.54	78.50	0.039	-28.29
-4.50	0.197	-14.11	7.75	0.268	-11.44	30.00	0.064	-23.94	54.50	0.067	-23.48	79.00	0.034	-29.50
-4.25	0.179	-14.94	8.00	0.245	-12.22	30.50	0.077	-22.33	55.00	0.067	-23.54	79.50	0.030	-30.60
-4.00	0.181	-14.87	8.25	0.215	-13.35	31.00	0.087	-21.21	55.50	0.064	-23.94	80.00	0.026	-31.87
-3.75	0.204	-13.81	8.50	0.181	-14.85	31.50	0.098	-20.22	56.00	0.057	-24.88	80.50	0.023	-32.77
-3.50	0.243	-12.29	8.75	0.147	-16.65	32.00	0.106	-19.53	56.50	0.048	-26.38	81.00	0.022	-33.15
-3.25	0.284	-10.93	9.00	0.118	-18.60	32.50	0.109	-19.29	57.00	0.039	-28.18	81.50	0.021	-33.56
-3.00	0.318	-9.95	9.25	0.096	-20.35	33.00	0.103	-19.74	57.50	0.033	-29.76	82.00	0.021	-33.56
-2.75	0.340	-9.37	9.50	0.086	-21.31	33.50	0.088	-21.11	58.00	0.032	-30.03	82.50	0.022	-33.15
-2.50	0.345	-9.26	9.75	0.085	-21.41	34.00	0.065	-23.74	58.50	0.037	-28.75	83.00	0.022	-33.15
-2.25	0.332	-9.58	10.00	0.086	-21.31	34.50	0.039	-28.29	59.00	0.043	-27.43	83.50	0.023	-32.77
-2.00	0.305	-10.33	10.50	0.082	-21.78	35.00	0.018	-34.89	59.50	0.047	-26.65	84.00	0.023	-32.77
-1.75	0.271	-11.34	11.00	0.067	-23.48	35.50	0.024	-32.40	60.00	0.048	-26.38	84.50	0.023	-32.77
-1.50	0.251	-12.01	11.50	0.066	-23.61	36.00	0.036	-29.00	60.50	0.046	-26.84	85.00	0.023	-32.77
-1.25	0.269	-11.40	12.00	0.083	-21.62	36.50	0.038	-28.40	61.00	0.039	-28.29	85.50	0.022	-33.15
-1.00	0.336	-9.49	12.50	0.097	-20.31	37.00	0.030	-30.46	61.50	0.028	-31.06	86.00	0.021	-33.76
-0.75	0.434	-7.25	13.00	0.095	-20.45	37.50	0.015	-36.48	62.00	0.016	-36.19	86.50	0.019	-34.42
-0.50	0.548	-5.22	13.50	0.088	-21.11	38.00	0.012	-38.42	62.50	0.004	-47.96	87.00	0.017	-35.39
-0.25	0.664	-3.56	14.00	0.100	-20.04	38.50	0.033	-29.76	63.00	0.017	-35.65	87.50	0.015	-36.48
0.00	0.772	-2.25	14.50	0.132	-17.62	39.00	0.053	-25.60	63.50	0.033	-29.76	88.00	0.013	-38.06
0.25	0.865	-1.26	15.00	0.161	-15.86	39.50	0.068	-23.41	64.00	0.047	-26.65	88.50	0.010	-40.00
0.50	0.936	-0.58	15.50	0.172	-15.31	40.00	0.077	-22.27	64.50	0.059	-24.58	89.00	0.008	-42.50
0.75	0.982	-0.16	16.00	0.158	-16.05	40.50	0.082	-21.78	65.00	0.069	-23.22	89.50	0.005	-46.94
1.00	1.000	0.00	16.50	0.122	-18.27	41.00	0.084	-21.51	65.50	0.076	-22.44	90.00	0.002	-56.48
1.25	0.989	-0.10	17.00	0.077	-22.33	41.50	0.086	-21.36	66.00	0.080	-21.99			
1.50	0.951	-0.44	17.50	0.037	-28.75	42.00	0.086	-21.31	66.50	0.080	-21.94			
1.75	0.890	-1.01	18.00	0.031	-30.31	42.50	0.085	-21.41	67.00	0.078	-22.21			
2.00	0.810	-1.84	18.50	0.041	-27.85	43.00	0.080	-21.99	67.50	0.073	-22.79			

TRASAR® Television Antenna Users

Station	Location		Channel	Model	Polarization	Azimuth Pattern	Year	Mount Type	Power Rating (kW)
WKHA	Hazard	KY	33	22H4	EP	O	2019	T	49
WIPX	Bloomington	IN	28	21H3	EP	O	2019	S	20
KWEX	San Antonio	TX	24	24H3	EP	S180	2019	S	82
WLFG	Grundy	VA	14	22H5	HP	O	2019	T	70
KKTV	Colorado Springs	CO	26	16H6	EP	C170	2019	S	20
WKMU-TV	Murray/Mayfield	KY	17	17H3	EP	O	2019	T	53
WKPD-TV	Paducah	KY	23	17H3	EP	OC	2019	T	51
WFWA-TV	Fort Wayne	IN	18	21H3	EP	S18x	2019	T	59
WKMR	Morehead	KY	30	22H3	EP	O	2019	T	49
WLGA	Opelika	AL	17	19H4	EP	CX	2018	S	50
WLGA	Opelika	AL	17	19H4	EP	CX	2018	S	25
KHSL	Chico	CA	36	16H4	EP	PX	2018	S	25
KXLA	Rancho Palos Verdes	CA	30	24H6	EP	C170	2018	S	50
KXLA	Rancho Palos Verdes	CA	30	24H6	EP	C170	2018	S	50
KNXT	Visalia	CA	22	12H7	EP	C2	2018	S	10
KKTV	Colorado Springs	CO	26	16H6	EP	C170	2018	S	15
WHFT	Miami	FL	28	13H3	HP	PX	2018	T	25
WUCF-TV	Orlando	FL	34	30HS3	EP	CX	2018	S	50
WUCF-TV	Orlando	FL	34	30HS3	EP	CX	2018	S	25
KIMT	Mason City	IA	24	21H3	EP	O	2018	T	25
KIMT	Mason City	IA	24	18H3	EP	O	2018	S	25
WFFT	Fort Wayne	IN	20	15H3	EP	TX	2018	T	25
WIPX	Indianapolis	IN	28	21H3	EP	O	2018	S	15
WGBY-TV	Springfield	MA	13	7VS5	EP	O	2018	T	25
WAQP	Saginaw	MI	36	28H3	EP	C1	2018	T	50
KSAX-TV	Alexandria	MN	24	22H3	EP	O	2018	T	10
KSTC-TV	Minneapolis	MN	30	26HS3	EP	O	2018	T	50
KSTP-TV	St. Paul	MN	35	26HS3	EP	O	2018	T	50
WRAL-TV	Raleigh	NC	17	25H4	EP	O	2018	T	75
WRAZ-TV	Raleigh	NC	15	25H4	EP	O	2018	T	75
WRAL/WRAZ	Raleigh	NC	15/17	25H3	EP	O	2018	S	75
WXXI	Rochester	NY	22	25H3	EP	C170	2018	T	50
WXXI	Rochester	NY	22	21H3	EP	C170	2018	S	10
WXXI-TV	Rochester	NY	22	25H3	EP	C170	2018	T	50
WXXI-TV	Rochester	NY	22	21H3	HP	C170	2018	S	10
WVPX	Cleveland	OH	22	29H3	EP	CX	2018	S	25
WHIO-TV	Dayton	OH	33	24HS3	HP	O	2018	T	50
WHIO-TV	Dayton	OH	33	26HS3	HP	O	2018	S	50
WTXF	Philadelphia	PA	31	18HS3	EP	O	2018	T	75
WAPA-TV	San Juan	PR	27/28	28HS7	EP	C1	2018	S	50
WTCI-TV	Chatanooga	TN	35	22H4	HP	O	2018	T	15
WTVF	Nashville	TN	36	24HS3	EP	O	2018	T	50
WTVF	Nashville	TN	36	16H3	HP	O	2018	S	50
KUBE	Baytown	TX	31	30HS4	EP	CX	2018	S	35
KDFI	Dallas	TX	27	28H3	EP	C1	2018	T	50
KTMD	Galveston	TX	22	19HS6	EP	CX	2018	T	50
KXLN	Rosenberg	TX	30	26H4	EP	CX	2018	T	50
KWEX	San Antonio	TX	24	24H3	EP	S180	2018	T	50
WLFG	Grundy	VA	14	22H5	HP	O	2018	T	25
PALMA	Brazil		41	8H3	EP	O	2018	T	10
KVPT	Fresno	CA	32	18H6	EP	C3	2017	T	25
WFWA	Fort Wayne	IN	18	21H3	EP	S18X	2017	S	25

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Station	Location		Channel	Model	Polarization	Azimuth Pattern	Year	Mount Type	Power Rating (kW)
WBKI	Salem	IN	16	21H3	EP	O	2017	T	50
WBKI	Salem	IN	16	19H3	HP	CX	2017	S	25
WDRB	Louisville	KY	32	25H3	EP	O	2017	T	50
WDRB	Louisville	KY	32	16H3	HP	CX	2017	S	25
WKAR-TV	East Lansing	MI	33	19HS4	EP	C170	2017	T	25
WBUY	Holly Springs	MS	26	19H3	HP	S	2017	S	25
WLIO	Lima	OH	8	4V3	CP	O	2017	T	15
WOHL	Lima	OH	15	6H3	CP	O	2017	T	25
KITU	Beaumont	TX	29	19H3	HP	S	2017	S	25
WHLA-TV	La Crosse	WI	15	20H3	EP	O	2017	T	50
KTNE	Alliance	NE	13	18V3	HP	O	2016	T	25
KCEC	Denver	CO	26	25H5	HP	C1	2015	S	25
WKPI	Pikeville	KY	24	19H4	HP	C	2015	T	25
WTVM-TV	Columbus	GA	11	12V5	EP	O	2014	T	20
WRNN-TV	Kingston	NY	48	24H3	HP	O	2014	T	25
KSBI-TV	Oklahoma City	OK	23	21HS4	EP	O	2014	S	60
WTCI-TV	Chattanooga	TN	29	18H6	HP	O	2014	T	25
TV Verdes Mares	BRAZIL		33	8H8	EP	C1	2014	S	15
WLGA-DT	Opelika	AL	30	24G475	HP	S	2013	S	20
KPHO-DT	Phoenix	AZ	17	4G450	HP	HSS	2013	S	30
WXXI-DT	Rochester	NY	16	25H3	EP	C170	2013	T	25
WGGS-TV	Greenville	SC	16	28H3	HP	CX	2013	T	25
WTVF-DT	Nashville	TN	25	24HS3	EP	O	2013	T	35
KEDT-DT	Corpus Christi	TX	23	28H4	EP	C170	2013	S	20
KUNS-DT	Bellevue	WA	50	28H3	EP	C1	2013	S	45
WEAU-TV	Eau Claire	WI	38	28H4	EP	O	2013	T	60
Televisão Cidade	BRAZIL		39	4H8	HP	O	2013	S	5
Televisão Cidade	BRAZIL		23	4H8	HP	O	2013	S	5
Televisão Cidade	BRAZIL		21	4H8	HP	O	2013	S	5
KSCI	Long Beach	CA	18	26H6	EP	C3	2012	T	25
KBOI-DT	Boise	ID	9	4V6	HP	Omni	2012	T	25
WNDU-DT	South Bend	IN	42	33H3	EP	O	2012	T	49
WJLC-DT	Beattyville	KY	7	10V5	HP	Cardioid	2012	T	25
WMVT	Milwaukee	WI	35	20H4	CP	CX	2012	T	56
WMVS	Milwaukee	WI	8	7V6	CP	Cardioid	2012	T	42
KKTV	Colorado Springs	CA	49	22HS6	EP	C1	2011	T	25
WKYT	Lexington	KY	36	26H3	EP	C	2011	S	25
WBUY	Holly Springs	MS	41	22H3	HP	S	2011	S	30
WEPH	Tupelo	MS	49	28H3	HP	C4	2011	S	50
WFTY-DT	Smithtown	NY	23	16H3	EP	S180	2011	T	45
WEMT-TV	Greenville	TN	38	20H6	EP	PX	2011	S	42
KFDM-TV	Beaumont	TX	25	28H3	EP	O	2011	T	35
WMVT	Milwaukee	WI	35	20H4	CP	CX	2011	T	56
WMVS	Milwaukee	WI	8	7V6	CP	Cardioid	2011	T	42
WTAP-TV	Parkersburg	WV	49	20H3	EP	O	2011	S	25
WTJP-DT	Gadsden	AL	26	28H3	HP	P	2010	S	50 Avg.
WFYI-DT	Indianapolis	IN	21	28H3	EP	O	2010	T	25
WJMN	Escanaba	MI	48	30H3	HP	C	2010	S	25
KNLJ	Jefferson City	MO	20	29H3	HP	C1	2010	T	50
WHKY-TV	Hickory	NC	40	25HS3	HP	WC	2010	S	50
KLDT	Lake Dallas	TX	38	28HS3	HP	O	2010	T	25
KSPS	Spokane	WA	7	8V7	EP	Omni	2010	T	42

TRASAR® Television Antenna Users

Station	Location		Channel	Model	Polarization	Azimuth Pattern	Year	Mount Type	Power Rating (kW)
KUAC-DT	Fairbanks	AK	9	6V3	EP	Omni	2009	T	45
WCFT-TV	Tuscaloosa	AL	33	30H3	EP	C1	2009	T	36
KATV-DT	Little Rock	AR	22	32H3	EP	O	2009	T	60
KHIZ-DT	Barstow	CA	44	24H4	HP	CX	2009	S	32
KFTR-DT	Ontario	CA	29	22HS6	EP	C1	2009	T	36
KBEH-DT	Oxnard	CA	24	30H4	CP	CX	2009	S	60
KRCA-DT	Riverside	CA	35	24HS6	EP	CX	2009	S	42
WPXM-DT	Miami	FL	35	19H3	HP	PX	2009	S	30
KFXB-DT	Dubuque	IA	43	16H3	HP	C4	2009	T	38
WGBO-DT	Joliet	IL	38	25HS4	EP	C2	2009	S	32
WJTR	Quincy	IL	32	25H3	HP	P	2009	T	40
WEHT-DT	Evansville	IN	7	9V3	CP	Omni	2009	T	42
WEHT-DT	Evansville	IN	7	2G150	HP	HSS	2009	S	10
KDCU-DT	Derby	KS	46	30H3	HP	O	2009	S	42
KVHP-DT	Lake Charles	LA	30	25H3	HP	T2	2009	T	60
WUTF-DT	Marlborough	MA	27	25H2	EP	S180	2009	T	34
WJBK-DT	Detroit	MI	7	8V5	CP	Cardioid	2009	T	40
WNMU-DT	Marquette	MI	13	9V3	HP	Omni	2009	T	40
WDIO-DT	Duluth	MN	10	15V4	EP	Omni	2009	T	40
WRPT-DT	Hibbing	MN	31	20H3	HP	P5	2009	S	42
WUNC-DT	Chapel Hill	NC	25	22HS3	EP	C	2009	T	36
WUNU-DT	Lumberton	NC	31	24HS4	HP	O	2009	S	15
WUNL-DT	Winston-Salem	NC	32	16HS4	EP	C170	2009	T	36
WOWT-DT	Omaha	NE	22	28HS3	EP	O	2009	T	60
WDLI-DT	Canton	OH	49	24H3	HP	C	2009	S	42
KDOR-DT	Bartlesville	OK	17	22H4	HP	C1	2009	T	42
WTXF-DT	Philadelphia	PA	42	12HS3	EP	C	2009	T	38
WQED-DT	Pittsburgh	PA	13	9V3	EP	Omni	2009	T	30
WTAJ	Scranton	PA	50	18H3	EP	O	2009	T	42
WPGD-DT	Hendersonville	TN	33	22H3	HP	SS	2009	S	27
KTBC-DT	Austin	TX	7	12V7	EP	Cardioid	2009	T	40
KNIC-DT	Blanco	TX	18	30H3	EP	SX	2009	S	78
KDLT	Lake Dallas	TX	39	28HS3	HP	C	2009	S	42
WSET-DT	Lynchburg	VA	13	9V3	HP	Omni	2009	T	42
WHRE-DT	Virginia Beach	VA	7	6V12	HP	Peanut	2009	S	28
KOMO	Seattle	WA	38	28H3	EP	O	2009	T	40
KHQ	Spokane	WA	15	25H4	EP	TX	2009	T	25
WXOW	Madison	WI	19	20H3	CP	O	2009	T	25
WFXS-DT	Wittenburg	WI	31	24H3	HP	CX	2009	S	42
WSAZ	Huntington	WV	23	23H5	EP	O	2009	T	40
	Barbados		7	6V5	HP	Omni	2009	T	30
	Brazil		22	6H15	EP	O	2009	T	10
KFSN-DT	Fresno	CA	30	30H6	HP	CX	2008	T	70
KTFK-DT	Stockton	CA	26	28H4	EP	P4	2008	S	53
KCEC-DT	Denver	CO	51	28H5	HP	C1	2008	S	37
KOAM-DT	Pittsburgh	KS	7	8V2	HP	Cardioid	2008	T	35
WGBY-DT	Springfield	MA	22	20H3	HP	O	2008	T	20
WJBK-DT	Detroit	MI	7	8V5	CP	Cardioid	2008	S	40
KEYC-DT	Mankato	MN	12	12V3	HP	Omni	2008	T	42
KSPR-DT	Springfield	MO	19	29HS3	EP	O	2008	S	82
WUNF-DT	Asheville	NC	25	12HS3	HP	C	2008	S	36
WRAL-DT	Raleigh	NC	48	25H5	EP	O	2008	T	75

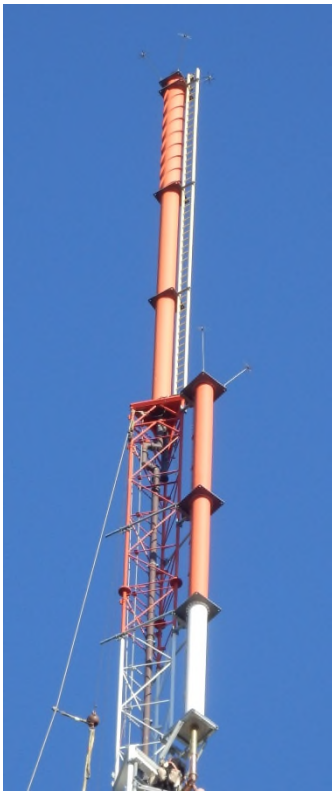
TRASAR® Television Antenna Users

Station	Location		Channel	Model	Polarization	Azimuth Pattern	Year	Mount Type	Power Rating (kW)
WUNP-DT	Roanoke Rapids	NC	36	24HS3	HP	O	2008	S	14
KTNE-DT	Alliance	NE	13	18V3	HP	Omni	2008	T	50
KTFQ-DT	Albuquerque	NM	22	28HS3	HP	PX	2008	S	32
WHP-DT	Harrisburg	PA	21	16HS4	HP	CX	2008	T	80
WNEP-DT	Scranton	PA	16	16H4	HP	T1	2008	S	60

Partial list of ERI TRASAR Television Antenna shipped over the last ten (1) years.

TRASAR® Product Information

The antenna proposed is a top mounted, end fed, coaxial slotted array design which is an elliptically polarized antenna.



ERI TRASAR UHF Television Antennas. Both the antennas pictured are elliptically polarized UHF antennas. One is top mounted on a lattice pedestal designed and built by ERI and a side mounted UHF TRASAR Antenna is mounted on one face of the pedestal.

Major features, benefits and construction characteristics that are common to all of the TRASAR antenna proposed include:

- All the antennas proposed are end fed deigns which are capable of achieving electrical beam tilts of more than 0.5 degrees, without any loss of power gain as beam tilt is introduced.
- There are no internal feed lines and therefore input power is limited only by size of antenna cross section. These are excellent designs for handling very high-power levels
- End fed antennas produce a naturally null free elevation pattern and can easily be designed to produce null free, smooth elevation patterns.
- The pressurized radome enclosures protect the antennas from harsh environments and provides adequate clearance so the ice formation does not affect operation.
- To further enhance reliability TRASAR antennas incorporate a fixed short and a patented bellows section in the inner conductor to compensate for the differential expansion between the inner and outer conductor.
- The fixed DC short across the internal feed line also protects the antenna against lightning damage.
- The methods and computer design tools developed and used by ERI Broadcast Products to design TRASAR antennas eliminate “beam wobble”.
- Beam wobble or beam steering is a change of the angular location of the antenna’s elevation beam.
- This is because the electrical spacing between slots is a function of frequency.
- ERI counters this by careful selection of the slot impedance and using non-uniform slot spacing.
- The net result is that the signal from the antenna arrives at a receiving location is essentially constant over the 6 MHz band.

Side mounted TRASAR antennas are constructed with rugged aluminum outer conductors and they are enclosed in a rugged fiberglass radome and they include two (2) top mounted lightning dissipaters. The antennas proposed include mounting brackets, priced separately, and the brackets supplied will be provided to support the antennas can be based on the selected mounting configuration in the event an optional scattering study is selected for the side mounted antenna proposed.

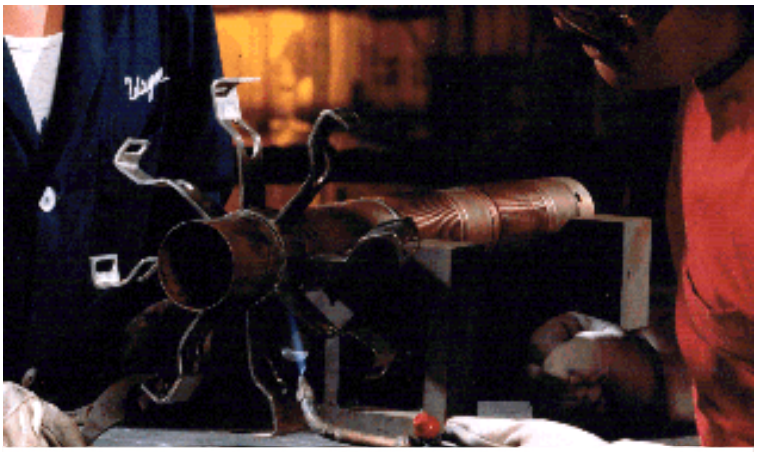
Top mounted antenna configurations are constructed with a galvanized steel outer conductor. These antennas are also enclosed in a pressurized radome. If the antenna is elliptically

polarized and omnidirectional then access to the beacon is provided by a fiberglass ladder which has a minimal effect on the azimuth pattern. The horizontally polarized omnidirectional antennas and directional antennas that are either horizontally of elliptically polarized include a galvanized steel climbing pole for beacon access. All top mounted TRASAR antennas include four (4) lightning spurs at the top of the antenna.

The antennas proposed is enclosed in aviation orange pressurized radome enclosures, other colors are optionally available. The radomes are pressurized and this prevents any ingress of moisture, dirt or other debris into the radome were it could have an impact on antenna performance and reduce the antenna's useful life. There is no periodic maintenance required for the coloring of the radome of the antenna proposed. The radome clearance for each antenna is sufficient to ensure that the impact of any ice formation on the outside of the radome with have negligible impact on the antenna's azimuth and elevation patterns. The recommended pressurization level of the antenna and transmission line system is 2.0 to 5.0 psi the antenna is rated to a maximum of 10 psi. If the antenna and transmission line pressurization is maintained there should be no need to break open the radome and access the antenna inner or outer conductor.

The bellows assembly and fixed DC short between the inner and outer conductor has no finger stock or sliding contacts and so there is no periodic inspection or maintenance associated with these elements. In the highly unlikely event access is required to the fixed short top mounted TRASAR antennas include a top radome section (see photo left) that is a special 12-inch length, and the climbing pole, or climbing ladder in the case of an omnidirectional elliptically polarized antenna, is attached in a manner that allows its removal without removing the antenna from the tower.

The antennas proposed are elliptically polarized models. ERI uses an independent dipole, separated from the slot, which emits the horizontally polarized component, and this allows the pattern to be optimized to the coverage requirements of the facility it is designed for. In the case of side mounted antennas this eliminates destructive reflections that result from undesirable reflections from the supporting structure and allows for significantly better performance in side mounted applications.



ERI TRASAR Differential Expansion Compensation Assembly

Climbing Facilities

Top mounted TRASAR with fiberglass ladder climbing facility used with omnidirectional circularly and elliptically polarized antennas to eliminate pattern distortion.

Top mounted TRASAR with galvanized steel climbing pole used with horizontally polarized and directional circularly and elliptically polarized antennas.

All ERI top mounted television antennas are provided with dedicated climbing facilities that do not penetrate the radome. This prevents potential contamination or moisture intrusion into the antenna radome which can cause corrosion, impact electrical performance and shorten the antenna useful life. This also provides climbers superior access to the beacon and improves safety.

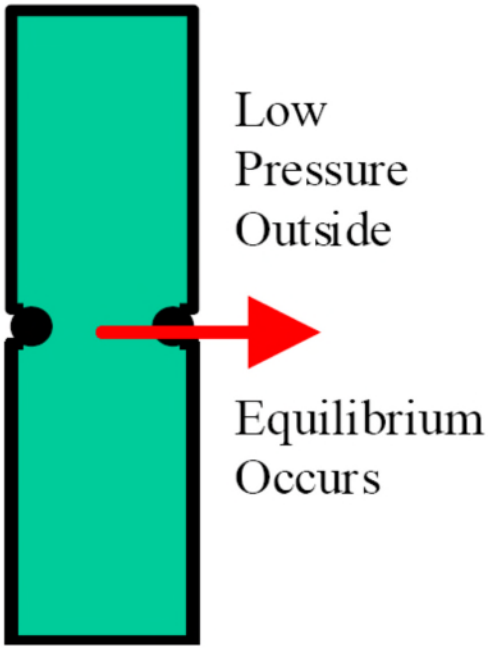
ERI elliptically polarized side mounted UHF television antenna under construction. The slots shown provide the horizontally polarized signal and the vertical dipoles between the slots emit the vertical signal component. This allows the horizontal plane patterns of the two polarizations to be optimized for the best over the air coverage for any given location and application.

Lifting & Handling Considerations

All ERI top mounted television antennas are provided with dedicated rigging lug attachments at the base of the antenna. This provides superior load control during lifting and installation. It also allows for reduced gin pole headroom (aka cantilever) which ultimately reduces the size of gin pole required. This also provides climbers superior access and safety.

Analysis of Pressurized Radome Enclosures

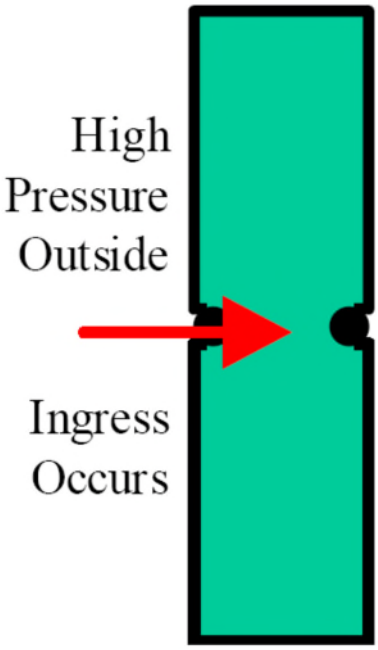
Pressurized radome enclosures eliminate the effects of the environment on the internal components of the antenna. This reduces the maintenance involved on a pressurized antenna to external damage to the radome, such as a lightning strike -- a very unlikely occurrence. In contrast, the likelihood of damage to the internal components of a non-pressurized antenna is great, as well as the probability that it will go unnoticed until catastrophic failure occurs.



Pressure Equilibrium in Low-Pressure Storm

Creating Enclosures

Waveguide and coaxial transmission lines contain many joints sealed with O-rings around the flanges. Terrestrial and satellite microwave transmission lines are similarly sealed and pressurized[2]. All such transmission lines contain critical junctions that would corrode or otherwise degrade in the presence of contaminants, and for this reason that almost all high-power broadcast transmission facilities have pressurization equipment supplying dry gas to transmission lines. These systems contain O-rings and high-pressure flanges providing a seal, and they are pressurized as well. With a sealed volume of air, or any other gas, a pressure vessel exists. Such volumes are created in an effort to eliminate ingress of water or other contaminants. A small amount of gas is leaked in every seal, and over time a pressure differential will not exist between the sealed volume of gas and the environment surrounding it.



High Pressure System Moves In

Efforts to create volumes sealed from environments that include the passage of weather systems are often thwarted by the pressure changes. A situation where the outside pressure rises above the pressure of the sealed environment is inevitable and accompanied by moisture. The moisture and other contaminants are ultimately pumped into the sealed volume. Without equipment to constantly provide greater pressure in the enclosure, water and other contaminants would be pumped into the sealed line every time a front passes.

[2] Whitaker, Jerry, ed., *NAB Engineering Handbook, 9th Edition,* Washington, DC, 1999

Ingress Protection Ratings

Levels of Protection	1st Digit	2nd Digit
0	No special protection	
1	Objects greater than 50mm in diameter.	Protection from dripping water.
2	Object not greater than 80mm in length and 12mm in diameter.	Protection from vertically dripping water.
3	Tools, wire, etc., of thickness greater than 1.0mm.	Protection from sprayed water.
4	Any object with a diameter or thickness greater than 1.0mm	Protection from splashed water.
5	Volume of dust that would interfere with operation	Protection from water projected from a nozzle
6	Dust tight.	Protection against heavy seas, or powerful jets of water.
7	NA	Protection against immersion.
8	NA	Protection against complete, continuous submersion in water.

Ingress Protection (IP) Ratings

The IEC Test Standard EN 60529[3] outlines an international classification system for the sealing effectiveness of enclosures of electrical equipment against the intrusion into the equipment of foreign objects (i.e. tools, dust, fingers) and moisture. This classification system uses the letters "IP" (“Ingress Protection”) followed by two digits.

The first digit of the IP code indicates the degree that persons are protected against contact with moving parts (other than smooth rotating shafts, etc.) and the degree that equipment is protected against solid foreign bodies intruding into an enclosure. The second digit indicates the degree of protection of the equipment inside the enclosure against the harmful entry of various forms of moisture (e.g. dripping, spraying, submersion, etc.).

Pressurized Antennas

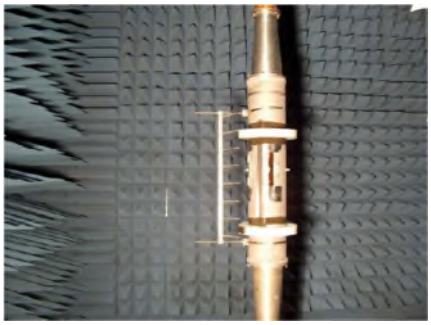
Broadcast television antennas have critical components that would be impaired greatly in the presence of water or other contaminants. Many antennas have flange junctions nearly identical to those critical junctions found in the transmission lines mentioned above. In addition, the performance of radiating elements, coupling devices, and power dividing components suffers if subjected to corrosive or contaminated environments. Without the use of pressurization equipment to eliminate the ingress of contaminants, periodic maintenance is required to clean and repair the damaged surfaces.

Pressure Protected Antenna After 30 Years of Service in Chicago

Ingress protected antenna equipment, with IP67 or better ratings, requires no periodic maintenance. No dust or debris from the harsh external environment will contaminate critical conducting surfaces and points of conductor contact. No water will be pumped into the antenna by passing storms and pressure changes. After 30 years of service, critical components will still be shiny and undamaged.

[3] IEC 60529, Edition 2.1, Degrees of protection provided by enclosures (IP Code), Geneva, Switzerland, 2001.

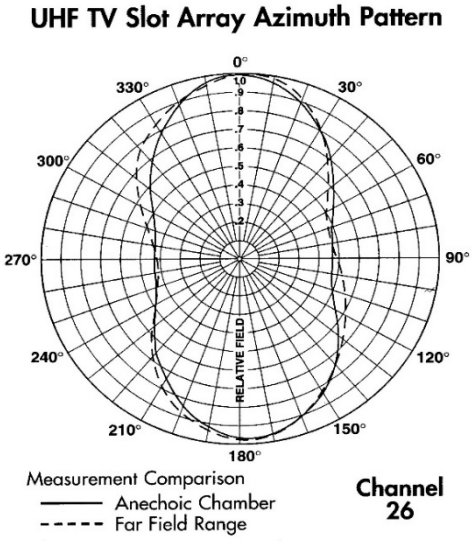
Array Antenna Pattern Measurement Techniques



ERI's Anechoic Chamber

Measurement of antenna patterns on a far-field test range, in a near-field environment, or in an anechoic chamber has been studied and standardized[4]. The correlation between measurements made in the far-field and those made in an anechoic chamber is also an active field of study[5]. Independent radiation pattern measurements of two UHF broadcast antenna arrays are compared and discussed.

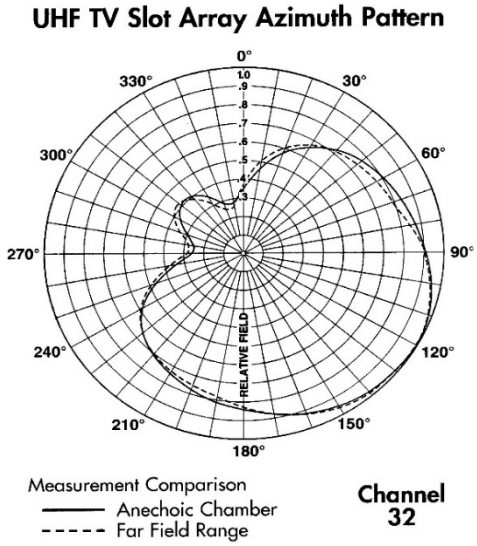
Two major areas of interest when specifying performance parameters for television transmitting antennas are elevation pattern and azimuth pattern. For proper coverage, a great deal of time, money and effort are usually expended to determine not only the ideal azimuth and elevation patterns but also their relationship to available transmitter power configurations and limitations. The final radiation pattern of any antenna is determined by the amplitude and phase distribution over the antenna aperture. The aperture effects can be divided into two separate and independent radiation characteristics: the azimuth pattern and the elevation pattern. The product of these two patterns gives the total radiation pattern for the antenna.



Azimuth Pattern Measurement

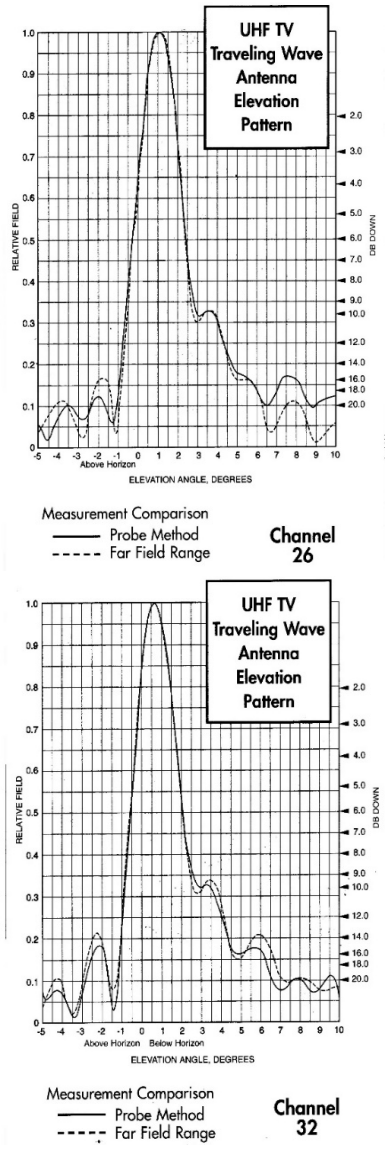
For UHF antennas, directional azimuth patterns are often chosen to optimize the coverage of the viewing area and to maximize the Effective Radiated Power (ERP) of the antenna by using the higher azimuth gains [5]. It is very important to eliminate all extraneous signals from the measurements or significant error can be introduced.

The appropriate conditions are accomplished by using an anechoic chamber for azimuth pattern testing. The anechoic chamber is designed with absorbing material that covers the walls, ceiling and floor to prevent any unwanted reflections during the measurement procedure. The anechoic chamber is a controlled measurement environment. It aims to represent the free space condition of the design criteria because it minimizes reflections and, at the same time, allows direct measurement of the azimuth pattern. It is not subject to the dynamic environmental influences that affect measurements on a far-field test range, reflections from buildings, vegetation, seasonal changes, rain, snow or ice. This assures both very accurate measurement results and repeatability of the results at any time.



[4] Kummer, W.H., ed., IEEE Standard Test Procedures for Antennas – IEEE Std 149-1979, John Wiley & Sons, Inc., New York, 1979
[5] Fourestie, B., et al, "On the Use of the Matrix-Pencil Method to Correlate Measurements at Different Test Sites," IEEE Trans. Antennas and Propagation, vol. 47, pp. 1569-1573, Oct. 1999.

If the geometry of the antenna array is the same at any cross section, it is only necessary to measure a full-scale segment of the array to determine the azimuth pattern of the full antenna. The factorization of the antenna pattern into an element pattern and array factor allows model studies and other investigations to be carried out where only the azimuth pattern is of interest. In order to provide the most accurate measurements possible and to ensure that the antenna is in strict conformance with the design requirements, an anechoic chamber is employed for antenna model measurements and production testing of broadcast antenna azimuth patterns. A full-scale, one-bay model for two antenna arrays was measured in an anechoic chamber and compared with patterns measured on the full array on a far field test range.



Elevation Pattern Measurement

To determine the elevation pattern of the antenna requires that the entire array be assembled and that the phase and amplitude distribution across the aperture be measured. Because reflections and extraneous signals can cause significant error in this measurement, ideally the antenna should be placed inside an anechoic chamber and the elevation pattern measured in the same manner as the azimuth pattern. However, the physical size and cost of such a structure prohibits this in the UHF band.
An alternate method of measurement was developed to simulate the "free space" condition of the anechoic chamber. This near-field method uses an isolated probe to measure the slot excitation (amplitude and phase) of each slot in the array.

With the measured data, α_i, β_i, and the known array geometry, d_i, the array factor may be computed by the following equation:

$$E(\theta) = \sum \alpha_1 e^{j(kd_i \cos\theta + \beta_i)}$$

where k is the propagation constant and θ is the elevation angle. The product of the array factor and the pattern of the one-bay element produce the elevation pattern. The measured data and pattern are compared with the design data for conformance to design specifications.

There are two major advantages of this measurement technique. Because the measurements are made in the near field, the effects of reflections and other unwanted signals are greatly reduced. Also, because the elevation pattern specifications are based on a particular phase and amplitude distribution across the aperture, a direct comparison between predicted and measured patterns and distributions is possible. This greatly accelerates the test program by eliminating the need to determine if any variances are caused by interference in the measurements. Any adjustments that are necessary are immediately visible as well as what corrective action is required. Again, this technique is a measurement of the radiation pattern near-field method for improving accuracy when comparing to the design criteria.

The elevation patterns of two UHF arrays were measured using the near-field sampling method and are compared with the direct far-field measurements.

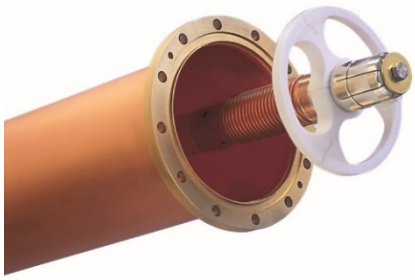
Pattern Comparisons

To better understand the ability to accurately measure the radiation patterns of a broadcast transmitting antenna, a comparison with traditional far-field measurements is shown. Variations in the azimuth pattern are less than 1dB, and variations in the main beam region of the elevation pattern are also less than 1dB. The differences may be attributed to undesirable reflections in the far-field test environment. The pattern data from the near-field probe measurement (for the elevation pattern) and the anechoic chamber (for the azimuth pattern) show excellent correlation with far-field test range results.

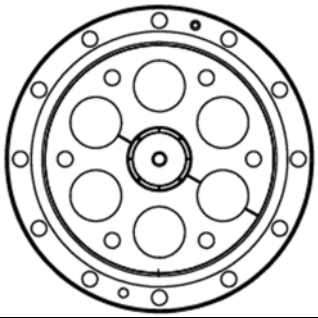
6-1/8-inch MACXLine Product Information

ERI manufactures a wide range of rigid transmission line products and components for broadcast applications. These products are manufactured at ERI's main facility in Chandler, Indiana, USA from the highest quality materials and with the latest fabrication technologies.

MACXLine® Rigid Line with Bellows Inner Connector



Made with heavy wall extruded copper inner and outer conductors, MACXLine® Rigid Line with Bellows Inner Connector is designed for exceptional reliability and long life. Six sizes, ranging from 3-1/8-inch through 8-3/16-inch, are available in original MACXLine®. ERI offers solutions optimized to meet your needs. ERI's field proven bellows expansion compensator accommodates the differential expansion between the inner and outer conductor and vertical and horizontal spring hangers are designed to support the system and compensate for differential expansion between the tower and vertical and horizontal runs. All the required system components and installation accessories can also be purchased from ERI.



6-1/8-inch, 75-ohm

Rigid Line Common Specifications

Size, Impedance	Outer Material	Velocity	Cutoff Frequency	Peak Power Rating	Production Test Voltage
6-1/8-inch, 75-ohm	CU and AL	99.8%	830 MHz	1060 kW	36 kV D.C.

	Outer	Outer Conductor				Inner Conductor			
Size, Impedance	Material	Outer Diameter		Inner Diameter		Outer Diameter		Inner Diameter	
6-1/8-inch, 75-ohm	CU	4.970-in	(126-mm)	6.125-in	(156-mm)	1.711-in	(43-mm)	1.631-in	(41-mm)

	Flange Information					
Size	Overall Diameter		Bolt Circle		Number of Bolts	Bolt Size
6-1/8-inch	8.120-in	(206-mm)	7.375-in	(187-mm)	12	3/8 in

Recommended Transmission Line Section Lengths

Rigid transmission line is manufactured in flanged sections of a fixed length. At each flange section all, rigid coaxial inner connectors exhibit a minor deviation from the characteristic impedance of the transmission line. This deviation causes a small amount of power to be reflected back to the RF source (VSWR). By using the correct fixed line length, the VSWR

buildup occurs outside the system's designed operating frequency. This needs to be considered for both digital television and FM service.

US Television Channels

20.00-foot (6.096 m) Section Length
Channels: 2, 3, 5, 6, 7, 8, 9, 11, 12, 14, 15, 18, 19, 22, 23, 27, 31, 32, 35, 36

19.75-foot (6.020 m) Section Length
Channels: 16, 20, 24, 28, 33

19.5-foot (5.944 m) Section Length
Channels: 4, 10, 13, 17, 21, 25, 26, 29, 30, 34

FM Radio Frequencies

Foot (Meter)	MHz
20.00 (6.096) Sections	88.1 - 95.9
	100.3 - 107.9
19.50 (5.944) Sections	96.1 - 98.3
19.00 (5.791) Sections	98.5 - 100.1
17.50 (5.342) Sections	88.1 – 107.9

Television channels listed are preferred, others may also be acceptable. Contact ERI for more information.

ERI 6-1/8-Inch, 75 Ohm, Rigid Transmission Lines Attenuation and Power Handling

Channel	Freq. (MHz)	Attn. (dB/100 feet)	Attn. (dB/100 meters)	Average Power (kW)	Channel	Freq. (MHz)	Attn. (dB/100 feet)	Attn. (dB/100 meters)	Average Power (kW)
2	57	0.034	0.111	198.2	20	509	0.103	0.337	65.2
3	63	0.036	0.116	188.5	21	515	0.103	0.339	64.8
4	69	0.037	0.122	180.0	22	521	0.104	0.341	64.4
5	79	0.040	0.131	168.1	23	527	0.105	0.343	64.0
6	85	0.041	0.136	162.0	24	533	0.105	0.345	63.7
7	177	0.060	0.196	111.7	25	539	0.106	0.347	63.3
8	183	0.061	0.200	109.9	26	545	0.106	0.349	62.9
9	189	0.062	0.203	108.1	27	551	0.107	0.351	62.6
10	195	0.063	0.206	106.4	28	557	0.108	0.353	62.2
11	201	0.064	0.210	104.7	29	563	0.108	0.355	61.9
12	207	0.065	0.213	103.2	30	569	0.109	0.357	61.6
13	213	0.066	0.216	101.7	31	575	0.109	0.359	61.2
14	473	0.099	0.324	67.7	32	581	0.110	0.360	60.9
15	479	0.100	0.326	67.2	33	587	0.110	0.362	60.6
16	485	0.100	0.329	66.8	34	593	0.111	0.364	60.3
17	491	0.101	0.331	66.4	35	599	0.112	0.366	60.0
18	497	0.101	0.333	66.0	36	605	0.112	0.368	59.6
19	503	0.102	0.335	65.6					

Specification and Design Notes:

Standard conditions for rating rigid lines are as follows. Attenuation: VSWR 1:1.0, ambient temperature 20°C (68°), atmospheric pressure, dry air.1 Average Power: VSWR 1:1.0, ambient temperature 40°C (104°F), inner conductor temperature 100°C (212°F), atmospheric pressure, dry air and no solar loading. The safety factor on peak power

ratings is 400% (safety factor of 2.0 on voltage) to allow for the possible effects of fine matchers, tuning slugs, etc. Also, the theoretical peak breakdown voltage is derated by 35% for production testing purposes, as done across the broadcast industry. Due to the difficulty of measuring the attenuation of large diameter rigid lines precisely, attenuation, (and consequently average power), ratings are calculated based on line geometry, copper losses and dielectric losses.

ERI rigid coaxial transmission lines are EIA compliant. To ensure high conductivity, they are made from ASTM B188 Alloy 102, Alloy 103 and Alloy 110 seamless copper tubes, which have an I.A.C.S rated conductivity at or above 99%. Temper is Hard Drawn, H80, for line sizes ≤ 3-1/8 inch and is rated Hard, H75, for sizes > 3-1/8 inch. The coefficient of thermal expansion is 9.4 x 10^{-6} in/(in/ºF) over 68°F – 212°F. Copper tube straightness is maintained at ≤ ½ inch per 20-foot length. This choice of copper material has been optimized in balancing the effects of both temperature and alloying elements on conductivity, as well as the need for strength, corrosion resistance and formability.

While typical RF broadcast transmission line systems are pressurized to 2-5 psig, ERI components are designed to handle 20 psig minimum. In RF applications, attenuation is affected by the nature of the signal to concentrate on the surface of the conductor due to skin effect, by some surface oxidation which is always present and also by small additional losses occurring at the flange interface. In order to ensure that attenuation ratings are conservative and agree closely with field-measured data, they include a derating factor on conductivity of 4 percentage points.

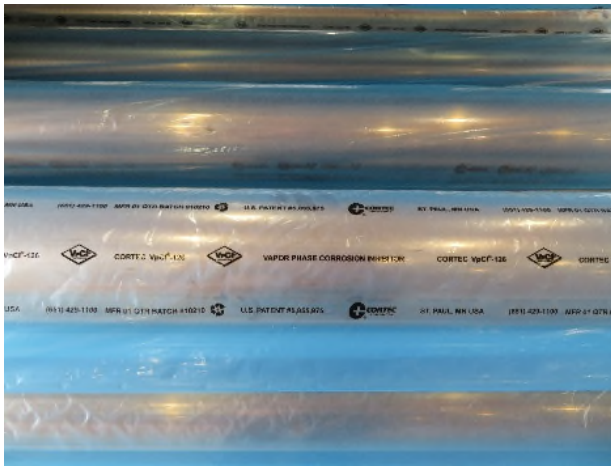
1) One atmosphere absolute dry air pressure at sea level is 0 psig (gauge reading) or 14.7 psia (absolute); where the gauge pressure = absolute pressure – 14.7 psia).

2) Conductivity of copper is expressed as a percentage of I.A.C.S (International Annealed Copper Standard) which is based upon annealed copper wire having a density of 8.89 g/cm³, 1 meter long, weighing 1 gram, with a resistance of 0.15328 ohms, such that the percentage was assigned as 100 times the ratio of volume resistivity at 68°F (20°C).

Transmission Line Shipment Packaging

Heat Shrink Skid Tarps Provide Long Term Weather Protection

Rigid transmission line components are usually shipped to site and outdoor storage is often required. All transmission line systems shipped from ERI are suitably packaged for outdoor storage. This includes bagging the individual line sections in CORTEC bags that are impregnated with a corrosion inhibitor and stacking the line sections in Styrofoam cradles that are strapped to a shipping skid and then fully enclosed in a weatherproof heat shrink cover. This process has been used by ERI for several years and it has been demonstrated to be an excellent way to store rigid line components outdoors, for long periods, without tarnishing.

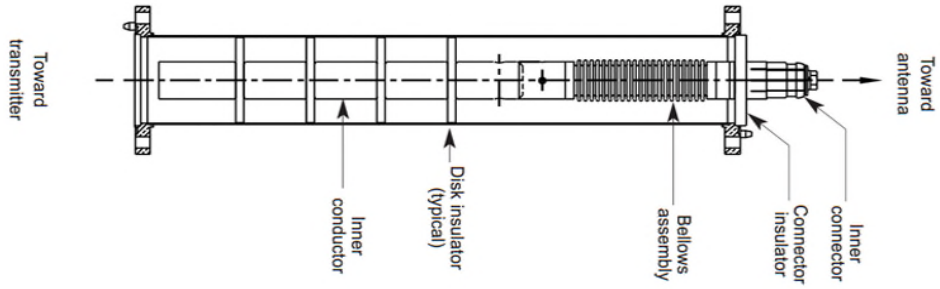


CORTEC Corrosion Inhibitor Impregnated Packing Sleeves

Styrofoam Stacking Cradles for Shipment and Storage

MACXLine® Standard Length Rigid Line Sections

MACXLine® standard length rigid line section come in standard section lengths of 20.00-foot (6.096-meter) detail "-1", 19.75-foot (6.020 meter) detail "-2", 19.50-foot (5.944 meter) detail "-3", 19.00-foot (5.791 meter) detail "-6"and 17.50-foot (5.342 meter) detail "-11". The detail "-D" line sections are for DUALine™ systems which use a specially engineered section length, that is the same for the entire system, to accommodate two (2) or three (3) television RF channels which are not able to use a standard line section length. The detail "W" line section are variable length line sections which are designed to provide a system which has a maximum VSWR of 1.1:1 or less for the entire UHF television band. Each line section includes the copper inner and outer conductor. The inner conductor includes the MACXLine fixed bullet/bellows expansion compensator. One flange hardware kit, with O ring is also included with each rigid line section.



MACXLine® Standard Rigid Line Sections

Part No.	Line Size	Impedance	Length		Section Weight	
MACX675B-1	6-1/8-inch	75 ohm	20.00-ft	(6.10-m)	119-lbm	(53.9-kg)
MACX675B-2	6-1/8-inch	75 ohm	19.75-ft	(6.02-m)	117-lbm	(53.3-kg)
MACX675B-3	6-1/8-inch	75 ohm	19.50-ft	(5.94-m)	116-lbm	(52.8-kg)
MACX675B-D	6-1/8-inch	75 ohm	Custom	--	TBD	
MACX675B-W	6-1/8-inch	75 ohm	Varies	--	Varies	

MACXLine® Variable Length Rigid Line Sections

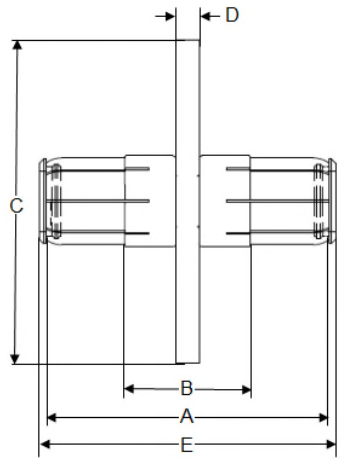
Special length MACXLine rigid line sections are available in any length and are a fixed price offering with detail numbers for variable length line sections up to 60.00-inches (1524-mm),

60.00-inches to 120.00-inches (1524-mm to 3048-mm) and 120.00-inches to 240.00-inches (3048-mm to 6096-mm). Each line section includes the copper inner and outer conductor. The inner conductor includes the MACXLine fixed bullet/bellows expansion compensator in variable length line sections greater than 60.00-inches (1524 mm). Variable length rigid line sections less than 60-inches (1524 mm), where the bellows compensator is not required, include a standard copper inner conductor with a captivated inner connector. One flange hardware kit, with O ring, is also included with each variable length rigid line section.

MACXLine® Variable Length Rigid Line Sections

Part No.	Line Size	Impedance	Length			
MACX675B-5	6-1/8-inch	75-ohm	0.00-in to	60.00-in	(0-mm to	1524-mm)
MACX675B-10	6-1/8-inch	75-ohm	60.00-in to	120.00-in	(1524-mm to	3048-mm)
MACX675B-20	6-1/8-inch	75-ohm	120.00-in to	240.00-in	(3048-mm to	6096-mm)

Standard Inner Connectors

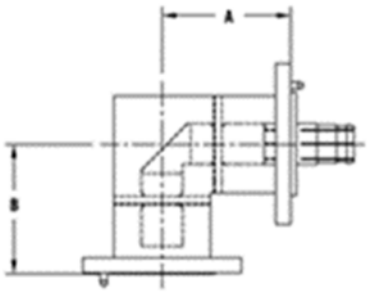


ACX675-20

Standard inner connectors are used in most field applications they should not be used if the inner connector is to support a line section inner conductor when being hoisted during installation.

Part Number	ACX675-20	
Size	6-1/8-inch	
Impedance	75 ohm	
Dim A	5.400-in	(137-mm)
Dim B	2.398-in	(61-mm)
Dim C	6.060-in	(154-mm)
Dim D	0.437-in	(11-mm)
Dim E	5.640-in	(143-mm)

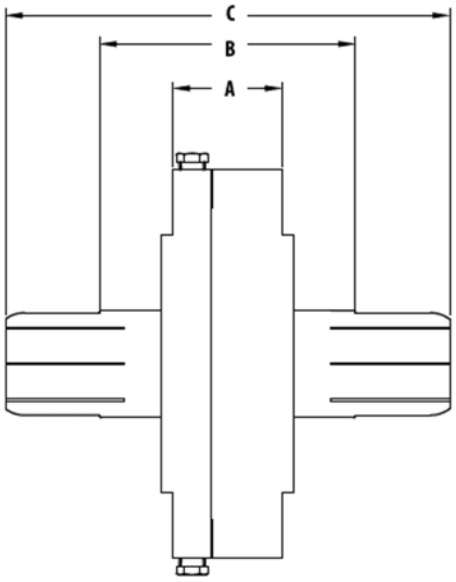
90-Degree Flanged Elbows



90-degree flanged miter elbows have supported inner conductors and swivel flanges. Each elbow includes one inner connector, O-ring, silicone grease and one flange hardware kit. They are pressure tight and suitable for indoor and outdoor applications. “-2” detail elbows include an outer conductor reinforcement gusset. “*” indicates an elbow that must be tuned to channel.

Part Number	ACX675-10SE		ACX675B-10SU	
Line Size	6-1/8-inch		6-1/8-inch	
Impedance	75-ohm		75-ohm	
Outer	Copper		Copper	
Leg A	5.500-in	(140-mm)	14.000-in	(356-mm)
Leg B	5.500-in	(140-mm)	7.000-in	(178-mm)
Weight	17.2-lbm	(7.8-kg)	21.5-lbm	(9.8-kg)

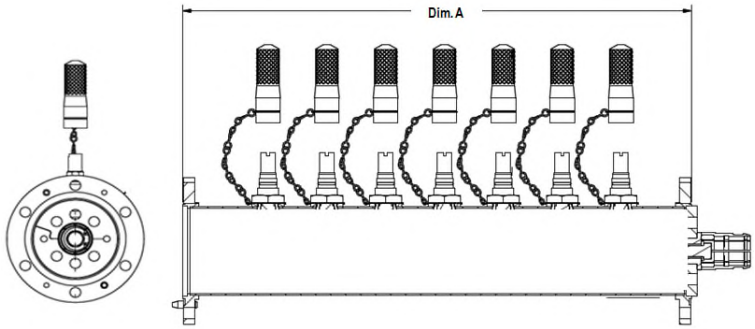
Gas Barriers



Gas barrier, both sides have at least one pressure port. The assembly has fixed male inner connectors both ends. Includes flange hardware kit.

Part Number	RLA675-16	
Line Size	6-1/8-inch	
Impedance	75 ohm	
Outer	Copper/Brass	
Dim A	1.630-in	(41-mm)
Dim B	8.120-in	(206-mm)
Dim C	4.051-in	(103-mm)
No of Ports	4	
Weight	17.7-lbm	(8.0-kg)

UHF Fine Matchers



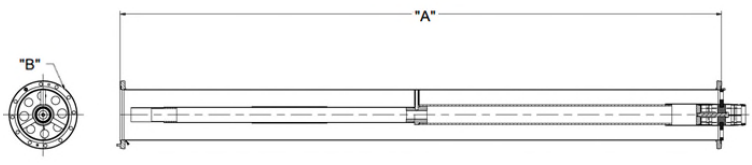
Coaxial fine matcher, flanged both ends for the UHF television broadcast band (470 to 800 MHz). Includes one captivated inner connector and one flange hardware kit. 7 tuners. 18-inches flange to flange. Tuners including locking nuts and pressure tight caps. Does not include mounting brackets or hardware. These are available from ERI at additional cost.

UHF Fine Matchers

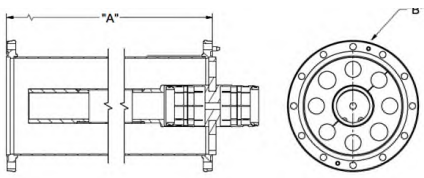
Part Number	Line Size	Impedance	Outer	Tuners	Dim A		Weight	
STD675B-FT	6-1/8-inch	75-ohm	Copper/Brass	Seven (7)	18.000-in	(457-mm)	24-lbm	(10.9-kg)

6-1/8-inch 50 to 75-ohm Impedance Transformers

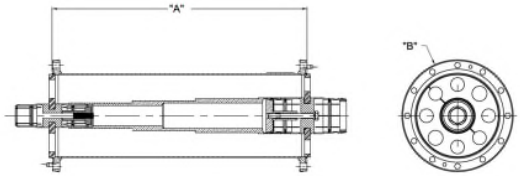
Connects 6-1/8-inch, 50-ohm, to 6-1/8-inch, 75-ohm transmission lines. Models are available for all television channels and the FM broadcast band.



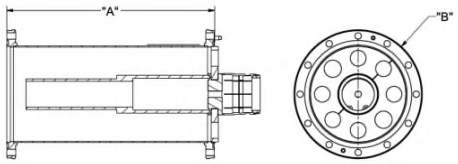
Model ACX675B-17-FM



Model ACX675B-17- (Channels 2 to 13)



Model ACX675B-17-W (Chanels 14 to 36)



Model ACX675B-17- (Channels 14 to 36)

50 to 75-ohm Impedance Transformers

Part No.	US RF Channel	Dim. "A"		Dim. "B"		Weight	
FM Band (88 to 108 MHz)							
ACX675B-FM	FM	72.00-in	(1829-mm)	8.166-in	(207-mm)	53-lbm	(23.8-kg)

FM 50 to 75-ohm impedance transformers include one (1) 6-1/8-inch, 50-ohm, captive inner connector and one (1) 6-1/8-inch flange hardware kit with O ring. 75-ohm connection is 6-1/8-inch, 75-ohm, EIA flanged, female. Return loss is -40 dB or better.

Low Band VHF Television							
ACX675B-17-2	2	56.28-in	(1430-mm)	8.166-in	(207-mm)	45-lbm	(20.4-kg)
ACX675B-17-3	3	51.35-in	(1304-mm)	8.166-in	(207-mm)	42-lbm	(19.1-kg)
ACX675B-17-4	4	47.28-in	(1201-mm)	8.166-in	(207-mm)	40-lbm	(18.1-kg)
ACX675B-17-5	5	43.86-in	(1114-mm)	8.166-in	(207-mm)	38-lbm	(17.2-kg)
ACX675B-17-6	6	40.95-in	(1040-mm)	8.166-in	(207-mm)	36-lbm	(16.3-kg)
High Band VHF Television							
ACX675B-17-7	7	21.19-in	(538-mm)	8.166-in	(207-mm)	25-lbm	(11.3-kg)
ACX675B-17-8	8	20.64-in	(524-mm)	8.166-in	(207-mm)	25-lbm	(11.3-kg)
ACX675B-17-9	9	20.13-in	(511-mm)	8.166-in	(207-mm)	25-lbm	(11.3-kg)
ACX675B-17-10	10	19.65-in	(499-mm)	8.166-in	(207-mm)	25-lbm	(11.3-kg)
ACX675B-17-11	11	19.20-in	(488-mm)	8.166-in	(207-mm)	25-lbm	(11.3-kg)
ACX675B-17-12	12	18.77-in	(477-mm)	8.166-in	(207-mm)	25-lbm	(11.3-kg)
ACX675B-17-13	13	18.37-in	(467-mm)	8.166-in	(207-mm)	25-lbm	(11.3-kg)

VHF television 50 to 75-ohm impedance transformers include one (1) 6-1/8-inch, 50-ohm, removal inner connector and one (1) 6-1/8-inch flange hardware kit with O ring. 75-ohm connection is 6-1/8-inch, 75-ohm, EIA flanged, female. Return loss is -40 dB or better.

UHF Television							
ACX675B-17-*	14 to 26	13.22-in	(336-mm)	8.166-in	(207-mm)	22-lbm	(10.0-kg)
ACX675B-17-**	27 to 36	11.65-in	(296-mm)	8.166-in	(207-mm)	20-lbm	(9.1-kg)

UHF television 50 to 75-ohm impedance transformers include one (1) 6-1/8-inch, 50-ohm, fixed inner connector and one (1) 6-1/8-inch flange hardware kit with O ring. 75-ohm connection is 6-1/8-inch, 75-ohm, EIA flanged, female. Return loss is -40 dB or better. * RF Channel 14 to 26 ** RF Channel 27 to 36

Wideband UHF Television							
ACX675B-17-W	14 to 36	18.73-in	(476-mm)	8.166-in	(207-mm)	26-lbm	(11.8-kg)

Wideband UHF television 50 to 75-ohm impedance transformers include one (1) 6-1/8-inch, 50-ohm, captive inner connector, one (1) captive 6-1/8-inch 75-ohm inner connector and one (1) 6-1/8-inch flange hardware kit with O ring. 75-ohm connection is 6-1/8-inch, 75-ohm, EIA flanged, male. Return loss is -35 dB or better at UHF channels.

Hangers and Support Accessories

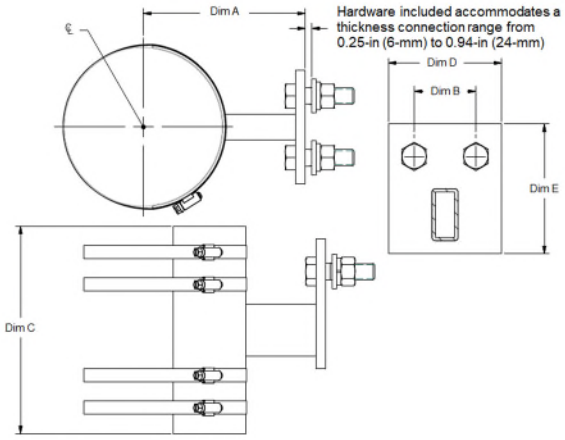
Rigid Line Vertical Hangers

Vertical Rigid Hangers

Rigid Line Rigid Hangers support the weight of the transmission line vertical run. Use two (2) at the tower top for up to 500-feet of vertical line. Add one additional fixed hanger at the tower top for each additional 500-feet of vertical run length.

All ERI rigid transmission line vertical rigid hangers are made with stainless steel.

Mounting hardware included: 1/2-inch diameter hardware requires mounting to 9/16-inch diameter holes. 5/8-inch diameter hardware requires 11/16-inch diameter mounting holes. The RLA600-13-2 includes slotted mounting holes to accommodate 2-3/8-inch to 2-1/2-inch mounting hole spacing.



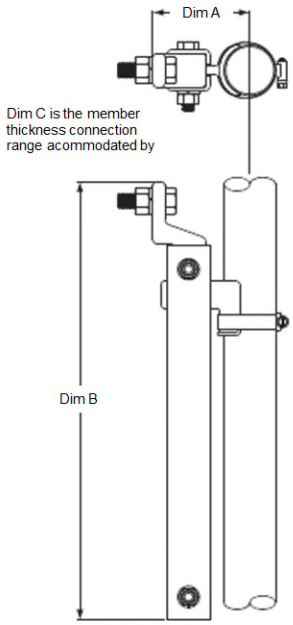
RLA600-13-2

Vertical Fixed Hangers

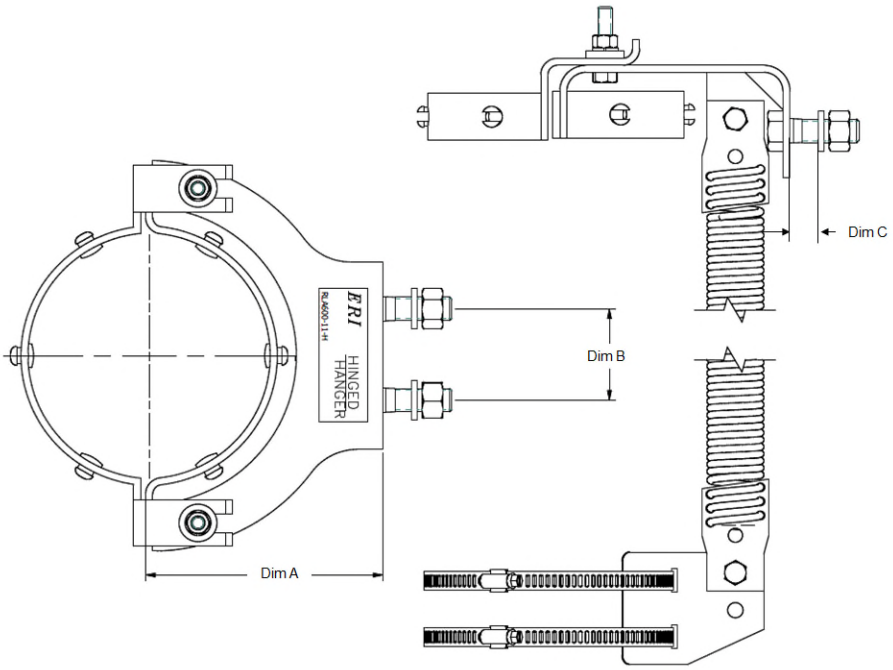
Part Number	Line Size	Dim A	Dim B	Dim C	Dim D	Dim E	Weight	Attachment Hardware
RLA600-13-2	6-1/8-inch	6.250-in (159-mm)	2.380 - 2.500-in (60 - 64-mm)	8.000-in (203-mm)	4.380-in (111-mm)	5.000-in (127-mm)	6.2-lbm (2.8-kg)	5/8-inch

Vertical Spring Hangers

For all other rigid coaxial line sizes ERI's offers its unique Hinged Vertical Spring Hanger, they support the transmission line vertical run while preventing lateral motion and accommodating differential expansion and contraction. For 3-1/8-inch and 4-1/16-inch rigid line one hanger and one vertical sliding ring is used on each line section. Transmission line systems of 6-1/8-inch, 7-3/16-inch and 8-3/16-inch rigid use two vertical spring hangers per line section for support. All vertical spring hangers and vertical sliding ring hangers are hinged to open from left or right side to save installation labor. Each hanger includes mounting hardware shown in the table below.



RLA-100-11-H 1-5/8-inch



RLA300-11-H, RAL400-11-H, RLA600-11-H, RLA700-11-H

Vertical Spring Hangers

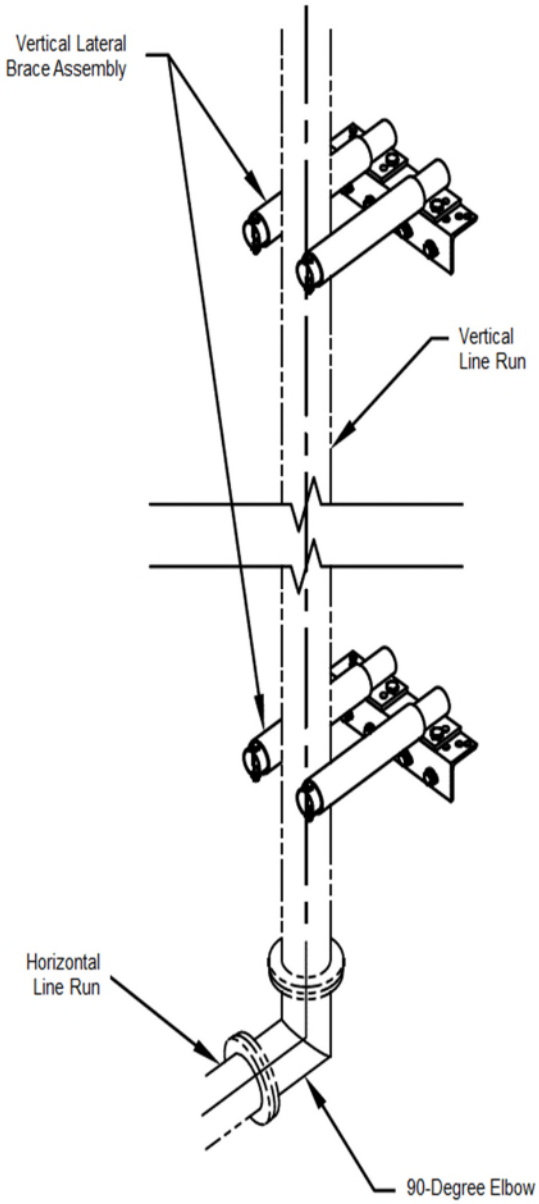
Part Number	Line Size	Dim A	Dim B	Dim C	Weight	Attachment Hardware
RLA600-11-H	6-1/8-inch	6.250-in (159-mm)	2.380 - 2.500-in (60 - 64-mm)	0.250 - 1.000-in (6 - 25-mm)	9.3-lbm (4.2-kg)	5/8-inch

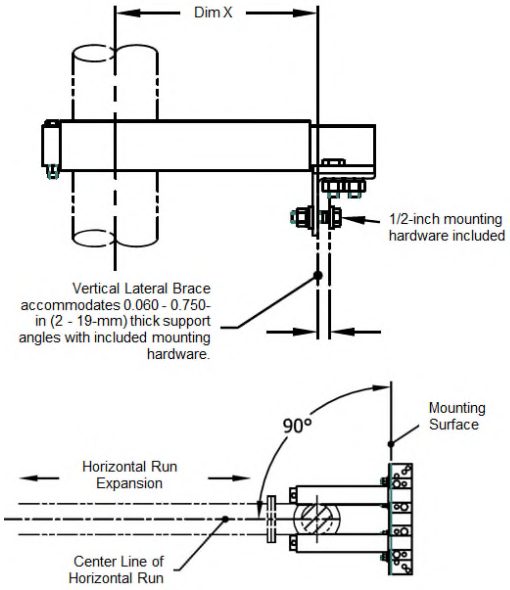
Minimum Distance to the Lowest Vertical Spring Hanger or Vertical Sliding Hanger

Horizontal Run Length	Copper Outer Conductor Rigid Line		Aluminum Outer Conductor Rigid Line	
Up to 100-feet (30.5-meters)	16.0-feet	(4.9-meters)	24.0-feet	(7.3-meters)
101-feet to 2000-feet (30.6-meters to 61.0-meters)	32.0-feet	(9.8-meters)	48.0-feet	(14.6-meters)

Vertical Lateral Braces

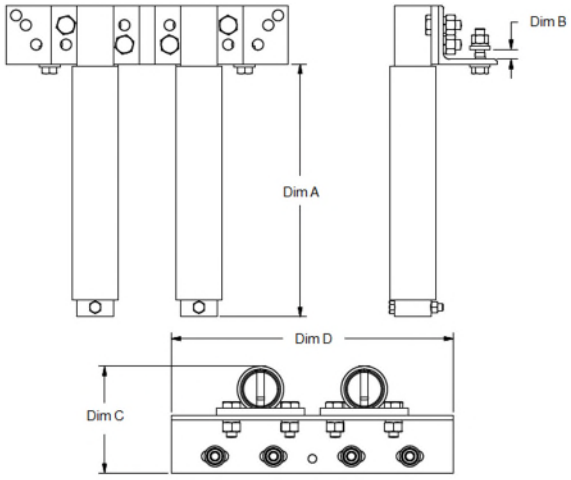
The Vertical Lateral Brace is an innovative unique product manufactured by ERI. These braces are used at the base of vertical run to prevent lateral motion and are universal with adjustments to accommodate all rigid transmission line sizes from 3-1/8-inch through 8-3/16-inch. Use two (2) vertical lateral guides equally spaced between the lowest vertical spring or sliding hanger and elbow at the base of the vertical run. Includes 1/2-inch mounting hardware.





Line Size	Dim X	
6-1/8-inch	6.250-in	(159-mm)

The line settings above are for horizontal transmission line runs up to 200-feet (61-meters).



Vertical Lateral Braces

Part Number	Dim A	Dim B	Dim C	Dim D	Weight	Attachment Hardware
RLA000-01VLB	13.000-in (330-mm)	0.060 - 0.750-in (2 - 19-mm)	5.510-in (140-mm)	14.500-in (368-mm)	11.2-lbm (5.1-kg)	1/2-inch

Rigid Line Horizontal Hangers

ERI provides a unique Horizontal Hanger System which uses components that are compatible with all rigid transmission line sizes from 3-1/8-inch through 8-3/16-inch. The system uses a Universal Horizontal Hanger Bracket and interchangeable Hanger Springs, Fixed Hanger Rods and a Universal Horizontal Lateral Brace. The system is engineered to allow many different support configurations and is particularly useful when adding new transmission lines to towers with multiple existing transmission line already installed under the transmission line bridge.

Minimum Horizontal Run Length

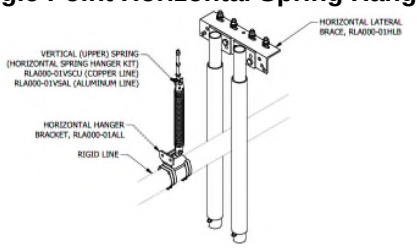
The entire length of the Minimum Horizontal Run length should be supported be horizontal spring hanger to accommodate differential expansion, beyond that length fixed hangers may be used. The Minimum Horizontal Run length should be the greater of 20-feet (6.1-meters) or:

Line Size	Copper Outer Conductor Rigid Line	Aluminum Outer Conductor Rigid Line
6-1/8-inch	6% of Vertical Run Height	10% of Vertical Run Height

Universal Horizontal Hanger System

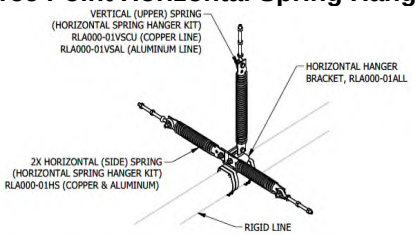
The ERI horizontal transmission line support system is made up of four (4) components that can be used to accommodate many different installation configurations. This system is particularly useful when adding new transmission line to an already crowded structure and in systems that use more than one transmission line to feed dual input FM and television master antennas. The components include the Universal Horizontal Hanger Bracket is compatible with all rigid transmission line sizes from 3-1/8-inch through 8-3/16-inch. It includes a stainless-steel bracket and stainless-steel hose clamps for all these transmission line sizes. The brackets accept a variety of accessory supports including Horizontal Vertical Support Springs, Horizontal Side Springs, Horizontal Fixed Supports. The separate Horizontal Lateral Brace assembly provides support to prevent lateral motion of the transmission line when the Universal Horizontal Hanger Bracket is used in single point mounting configurations.

Single Point Horizontal Spring Hanger



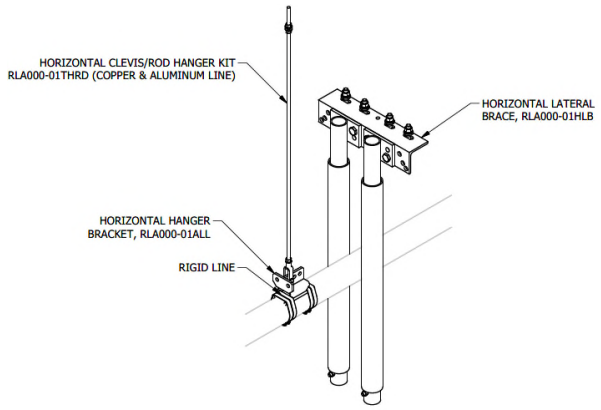
This configuration requires one (1) RLA000-01ALL Universal Horizontal Hanger Bracket and one (1) RLA000-01VSxx (xx="CU" for Copper Outer Conductor Line or xx="AL" for Aluminum Outer Conductor Line) Horizontal Vertical Spring. The horizontal hanger spacing should be an average of 480-inches (12,192-mm) for 3-1/8 and 4-1/16-inch Aluminum Outer Conductor Rigid Line, 240-inches (6,096-mm) for 3-1/8 and 4-1/16-inch Copper Outer Conductor or 6-1/8-inch Aluminum Outer Conductor Rigid Line and 120-inches (3,048-mm) 6-1/8, 7-3/16 and 8-3/17-inch Copper outer Conductor Rigid Line. In addition, an RLA000-01HLB Horizontal Lateral Brace to prevent lateral motion should be installed every 240-inches (6,096-mm) for the entire length of the horizontal run.

Three Point Horizontal Spring Hanger



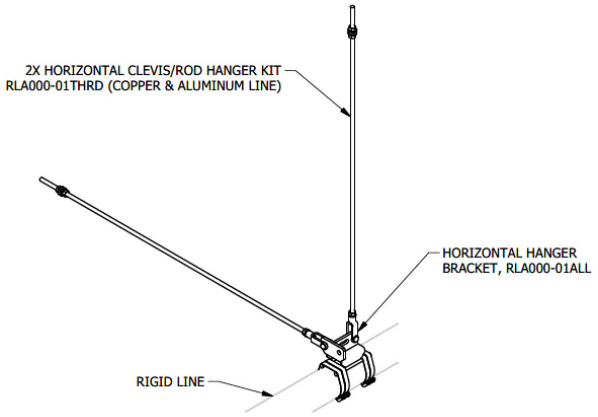
This configuration requires one (1) RLA000-01ALL Universal Horizontal Hanger Bracket, one (1) RLA000-01VSxx (xx="CU" for Copper Outer Conductor Line or xx="AL" for Aluminum Outer Conductor Line) Horizontal Vertical Spring and two (2) RLA000-1HS Horizontal Side Springs. The horizontal hanger spacing should be an average of 480-inches (12,192-mm) for 3-1/8 and 4-1/16-inch Aluminum Outer Conductor Rigid Line, 240-inches (6,096-mm) for 3-1/8 and 4-1/16-inch Copper Outer Conductor or 6-1/8-inch Aluminum Outer Conductor Rigid Line and 120-inches (3,048-mm) 6-1/8, 7-3/16 and 8-3/17-inch Copper outer Conductor Rigid Line. When this configuration is used the RLA000-01HLB Horizontal Lateral Brace to prevent lateral motion is not required.

Single Point Horizontal Fixed Hanger



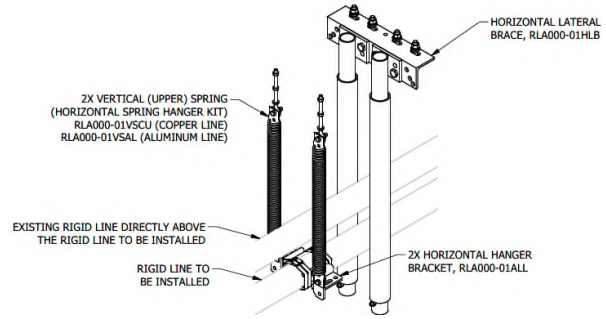
This configuration requires one (1) RLA000-01ALL Universal Horizontal Hanger Bracket and one (1) RLA000-01THRD Horizontal Clevis/Rod Hanger Kit. The horizontal hanger spacing should be an average of every 120-inches (3,048-mm) for all rigid line sizes and types. In addition, an RLA000-01HLB Horizontal Lateral Brace to prevent lateral motion should be installed every 240-inches (6,096-mm) for the entire length of the horizontal run. NOTE: Horizontal fixed hangers should only be installed beyond the minimum horizontal run length (see table page 88).

Two Point Horizontal Fixed Hanger



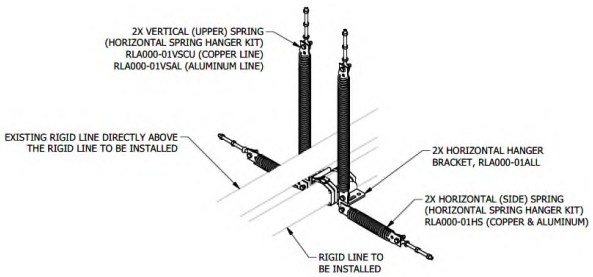
This configuration requires one (1) RLA000-01ALL Universal Horizontal Hanger Bracket and two (2) RLA000-01THRD Horizontal Clevis/Rod Hanger Kit. The horizontal hanger spacing should be an average of every 120-inches (3,048-mm) for all rigid line sizes and types. When this configuration is used the RLA000-01HLB Horizontal Lateral Brace to prevent lateral motion is not required. NOTE: Horizontal fixed hangers should only be installed beyond the minimum horizontal run length (see table page 88).

Two Point Horizontal Spring Hanger



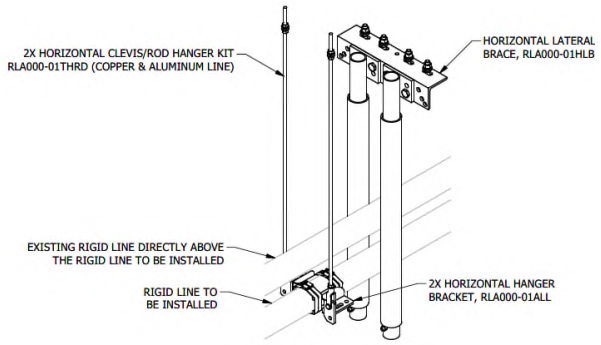
This configuration requires two (2) RLA000-01ALL Universal Horizontal Hanger Bracket and two (2) RLA000-01VSxx (xx="CU" for Copper Outer Conductor Rigid Line or xx="AL" for Aluminum Outer Conductor Rigid Line) Horizontal Vertical Spring. The horizontal hanger spacing should be an average of 480-inches (12,192-mm) for 3-1/8 and 4-1/16-inch Aluminum Outer Conductor Rigid Line, 240-inches (6,096-mm) for 3-1/8 and 4-1/16-inch Copper Outer Conductor or 6-1/8-inch Aluminum Outer Conductor Rigid Line and 120-inches (3,048-mm) 6-1/8, 7-3/16 and 8-3/17-inch Copper outer Conductor Rigid Line. In addition, an RLA000-01HLB Horizontal Lateral Brace to prevent lateral motion should be installed every 240-inches (6,096-mm) for the entire length of the horizontal run.

Two Point Horizontal Spring Hanger



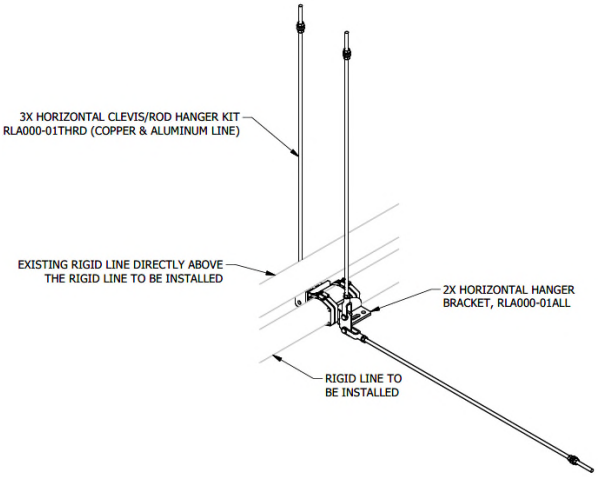
This configuration requires two (2) RLA000-01ALL Universal Horizontal Hanger Bracket, two (2) RLA000-01VSxx (xx="CU" for Copper Outer Conductor Rigid Line or xx="AL" for Aluminum Outer Conductor Rigid Line) Horizontal Vertical Spring and two (2) RLA000-1HS Horizontal Side Springs. The horizontal hanger spacing should be an average of 480-inches (12,192-mm) for 3-1/8 and 4-1/16-inch Aluminum Outer Conductor Rigid Line, 240-inches (6,096-mm) for 3-1/8 and 4-1/16-inch Copper Outer Conductor or 6-1/8-inch Aluminum Outer Conductor Rigid Line and 120-inches (3,048-mm) 6-1/8, 7-3/16 and 8-3/17-inch Copper outer Conductor Rigid Line.

Two Point Horizontal Fixed Hanger

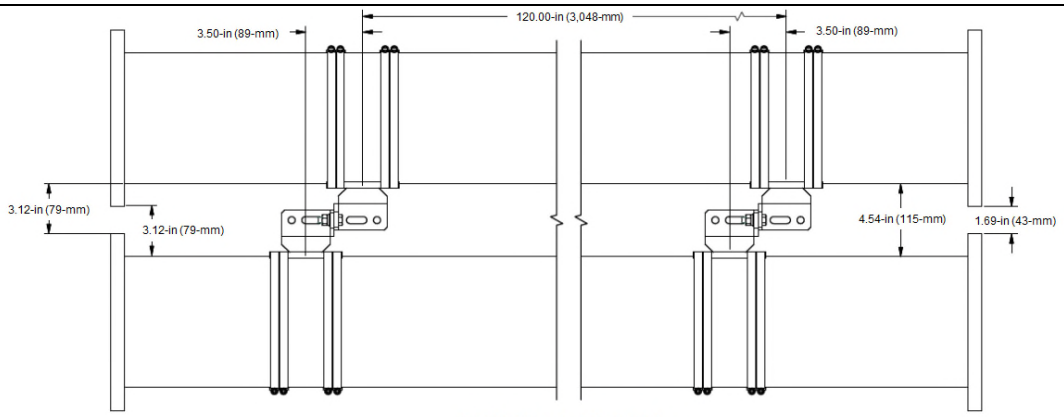


This configuration requires two (2) RLA000-01ALL Universal Horizontal Hanger Bracket and two (2) RLA000-01THRD Horizontal Clevis/Rod Hanger Kit. The horizontal hanger spacing should be an average of every 120-inches (3,048-mm) for all rigid line sizes and types. In addition, an RLA000-01HLB Horizontal Lateral Brace to prevent lateral motion should be installed every 240-inches (6,096-mm) for the entire length of the horizontal run. NOTE: Horizontal fixed hangers should only be installed beyond the minimum horizontal run length (see table page 88).

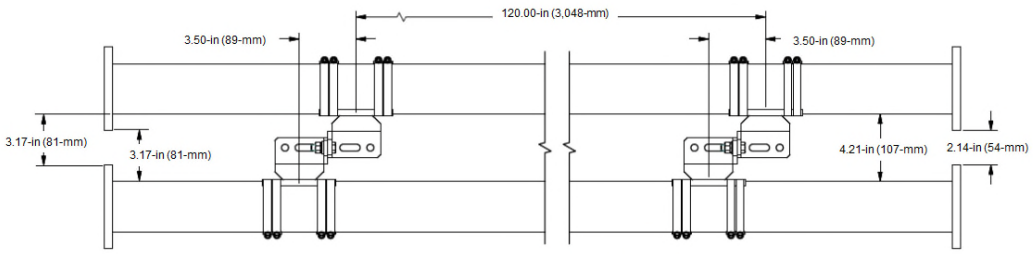
Three Point Horizontal Fixed Hanger



This configuration requires two (2) RLA000-01ALL Universal Horizontal Hanger Bracket and three (3) RLA000-01THRD Horizontal Clevis/Rod Hanger Kit. The horizontal hanger spacing should be an average of every 120-inches (3,048-mm) for all rigid line sizes and types. When this configuration is used the RLA000-01HLB Horizontal Lateral Brace to prevent lateral motion is not required. NOTE: Horizontal fixed hangers should only be installed beyond the minimum horizontal run length (see table page 88).



8-3/16-inch Rigid Line

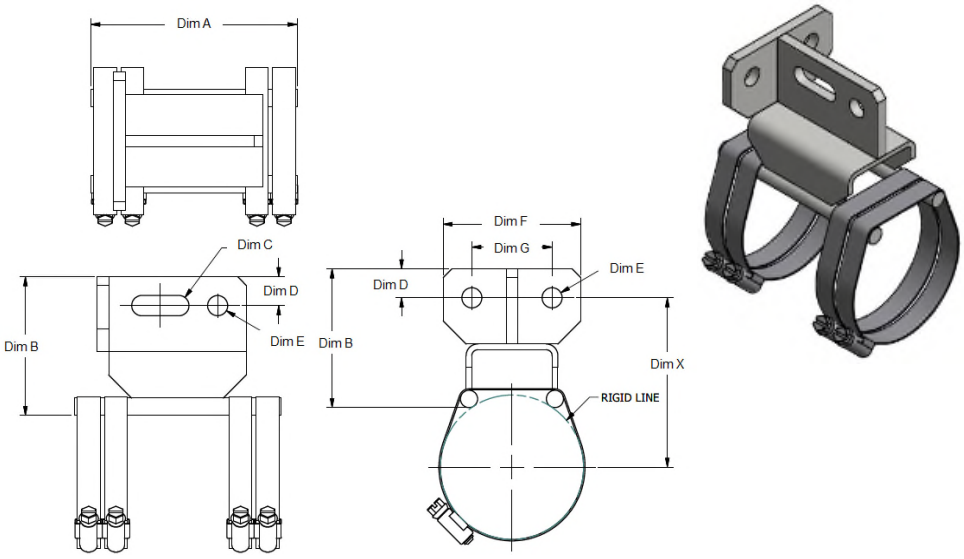


3-1/8-inch Rigid Line

RLA000-01ALL Horizontal Hanger Brackets configured to support two transmission lines side by side.

Universal Horizontal Hanger Brackets

The Universal Horizontal Hanger Bracket includes the bracket assembly and a quantity of four (4) HC0062 Stainless Steel Hose Clamps (2.500-in (64-mm) to 4.500-in (114-mm)) for 3-1/8-inch and 4-1/16 rigid transmission lines and four (4) HC0128 Stainless Steel Hose Clamps (2.500-in (64-mm) to 8.500-in (216-mm)) for 6-1/8-inch, 7-3/16-inch and 8-3/16-inch rigid lines. This bracket is used in combination with the RLA000-01VSCU Horizontal Vertical Spring for Copper Outer Conductor Rigid Line or the RLA000-01VSAL Horizontal Vertical Spring for Aluminum Outer Conductor Rigid Line to provide vertical support for the weight of the horizontal run while allowing the differential expansion of the vertical transmission line run. lateral support is provided by adding two (2) RLA000-1HS Horizontal Side Springs or using the RLA000-01HLB Horizontal Lateral Brace. The horizontal hanger spacing should be an average of 480-inches (12,192-mm) for 3-1/8 and 4-1/16-inch Aluminum Outer Conductor Rigid Line, 240-inches (6,096-mm) for 3-1/8 and 4-1/16-inch Copper Outer Conductor or 6-1/8-inch Aluminum Outer Conductor Rigid Line and 120-inches (3,048-mm) 6-1/8, 7-3/16 and 8-3/17-inch Copper outer Conductor Rigid Line. In addition, an RLA000-01HLB Horizontal Lateral Brace to prevent lateral motion should be installed every 240-inches (6,096-mm) for the entire length of the horizontal run. Beyond the length of Minimum Horizontal Run (see Table on Page 88) the Universal Horizontal Hanger Bracket can be used with the RLA000-01THRD Horizontal Clevis/Rod Hanger Kit. The horizontal hanger spacing should average of every 120-inches (3,048-mm) for all rigid line sizes and types. In addition, an RLA000-01HLB Horizontal Lateral Brace to prevent lateral motion should be installed every 240-inches (6,096-mm) for the entire length of the horizontal run if no other lateral support is provided by Horizontal Side Springs or Horizontal Clevis/Rod Kits.

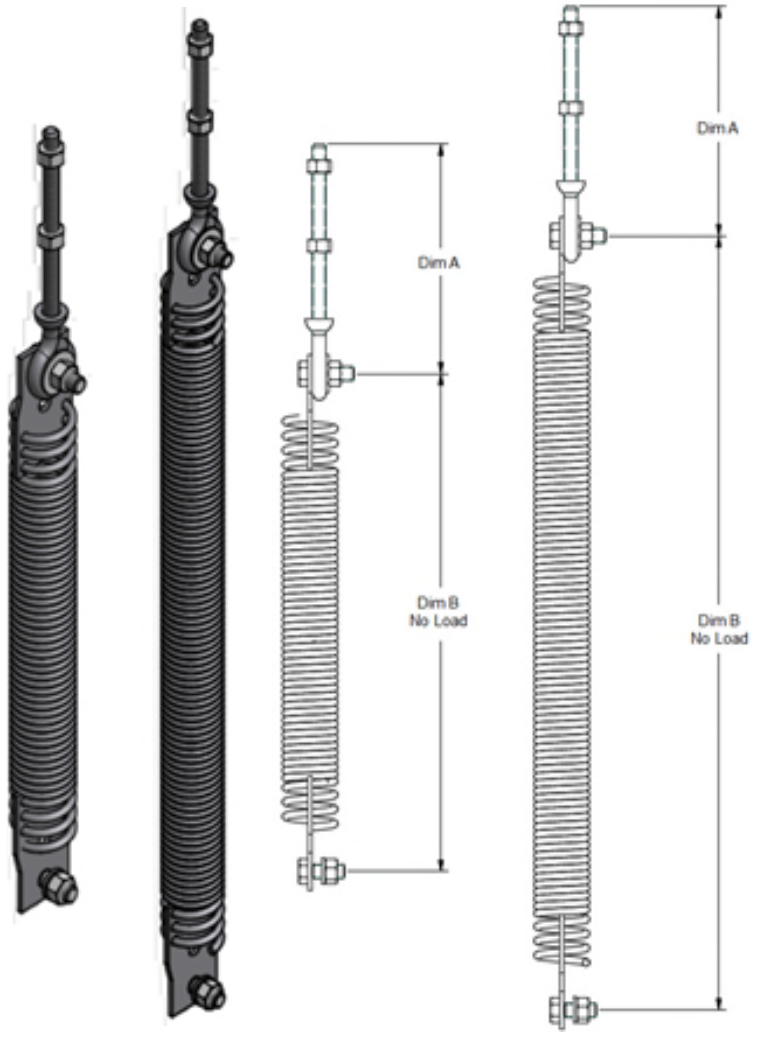


Universal Horizontal Hanger Bracket

Part Number		RLA000-01ALL			
Dim A	4.500-in	(114-mm)	**Line Size**	**Dim X**	
Dim B	3.000-in	(76-mm)	3-1/8-inch	3.670-in	(93-mm)
Dim C	0.44 x 1.25-in	11 x 32-mm	4-1/16-inch	4.200-in	(107-mm)
Dim D	0.625-in	(16-mm)	6-1/8-inch	5.300-in	(135-mm)
Dim E	0.440-in	(11-mm)	7-3/16-inch	5.830-in	(148-mm)
Dim F	3.000-in	(76-mm)	8-3/16-inch	6.350-in	(161-mm)
Dim G	1.750-in	(44-mm)			
Weight	1.6-lbm	(0.7-kg)			

Horizontal Vertical Springs

The Horizontal Vertical Spring comes in two (2) versions the RLA000-01VSCU for Copper Outer Conductor Rigid Line and the RLA000-01VSAL for Aluminum Outer Conductor Rigid Line. These are used in combination with the RLA000-01ALL Universal Horizontal Hanger Bracket to provide vertical support for the weight of the horizontal run while allowing the differential expansion of the vertical transmission line run, lateral support is provided by adding two (2) RLA000-1HS Horizontal Side Springs or using the RLA000-01HLB Horizontal Lateral Brace. The horizontal hanger spacing should be an average of 480-inches (12,192-mm) for 3-1/8 and 4-1/16-inch Aluminum Outer Conductor Rigid Line, 240-inches (6,096-mm) for 3-1/8 and 4-1/16-inch Copper Outer Conductor or 6-1/8-inch Aluminum Outer Conductor Rigid Line and 120-inches (3,048-mm) 6-1/8, 7-3/16 and 8-3/16-inch Copper outer Conductor Rigid Line. In addition, an RLA000-01HLB Horizontal Lateral Brace to prevent lateral motion should be installed every 240-inches (6,096-mm) for the entire length of the horizontal run.



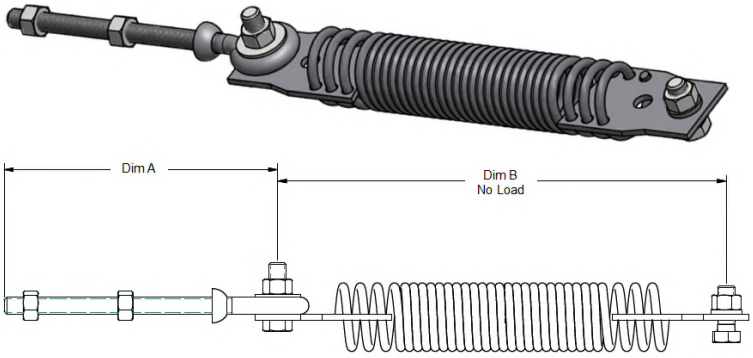
Horizontal Vertical Springs

Part Number	RLA000-01VSCU
Line Type	Copper Outer
Dim A	6.000-in (152-mm)
Dim B	13.400-in (340-mm)
Weight	2.4-lbm (1.1-kg)
Attachment Hardware	3/8-inch
Part Number	**RLA000-01VSAL**
Line Type	Aluminum Outer
Dim A	6.000-in (152-mm)
Dim B	20.500-in (521-mm)
Weight	3.6-lbm (1.6-kg)
Attachment Hardware	3/8-inch

Horizontal Side Springs

The Horizontal Side Spring, Part Number RLA000-01HS are used in pairs (two (2)) in combination with the RLA000-01ALL Universal Horizontal Hanger Bracket and the RLA000-01VSCU Horizontal Vertical Spring for Copper Outer Conductor Rigid Line or the RLA000-01VSAL Horizontal Vertical Spring for Aluminum Outer Conductor Rigid Line to provide lateral upport to the horizontal transmission line run while allowing the differential expansion of the vertical transmission line run. The horizontal hanger spacing should be an average of 480-

inches (12,192-mm) for 3-1/8 and 4-1/16-inch Aluminum Outer Conductor Rigid Line, 240-inches (6,096-mm) for 3-1/8 and 4-1/16-inch Copper Outer Conductor or 6-1/8-inch Aluminum Outer Conductor Rigid Line and 120-inches (3,048-mm) 6-1/8, 7-3/16 and 8-3/17-inch Copper outer Conductor Rigid Line. When this configuration is used the RLA000-01HLB Horizontal Lateral Brace to prevent lateral motion is not required.

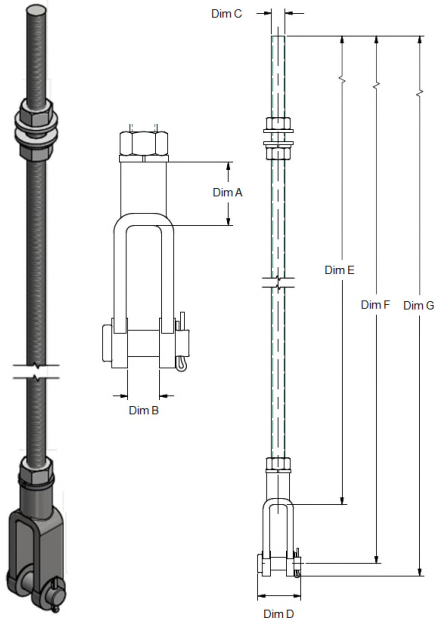


Horizontal Side Springs

Part Number	RLA000-01HS
Dim A	6.000-in (152-mm)
Dim B	9.600-in (244-mm)
Weight	1.8-lbm (0.8-kg)
Attachment Hardware	3/8-inch

Horizontal Clevis/Rod Kits

The Horizontal Clevis/Rod Kit, Part Number RLA000-01THRD are used in combination with the RLA000-01ALL Universal Horizontal Hanger Bracket to provide vertical support for the weight of the horizontal run while allowing expansion and contraction of the horizontal run. They are to be used beyond the length of Minimum Horizontal Run (see Table on Page 88). A second Horizontal Clevis/Rod Kit can be installed horizontally to provide the required lateral support to the horizontal transmission line run while allowing the differential expansion of the horizontal transmission line run. When this configuration is used the RLA000-01HLB Horizontal Lateral Brace to prevent lateral motion is not required. The horizontal hanger spacing should be an average of every 120-inches (3,048-mm) for all copper outer conductor rigid line sizes and 240-inches (6,096-mm) for all aluminum outer conductor rigid line. In cases were a horizontal rod cannot be installed an RLA000-01HLB Horizontal Lateral Brace can be used to prevent lateral motion should be installed every 240-inches (6,096-mm) for the entire length of the horizontal run if no other lateral support is provided by Horizontal Side Springs or Horizontal Clevis/Rod Kits.

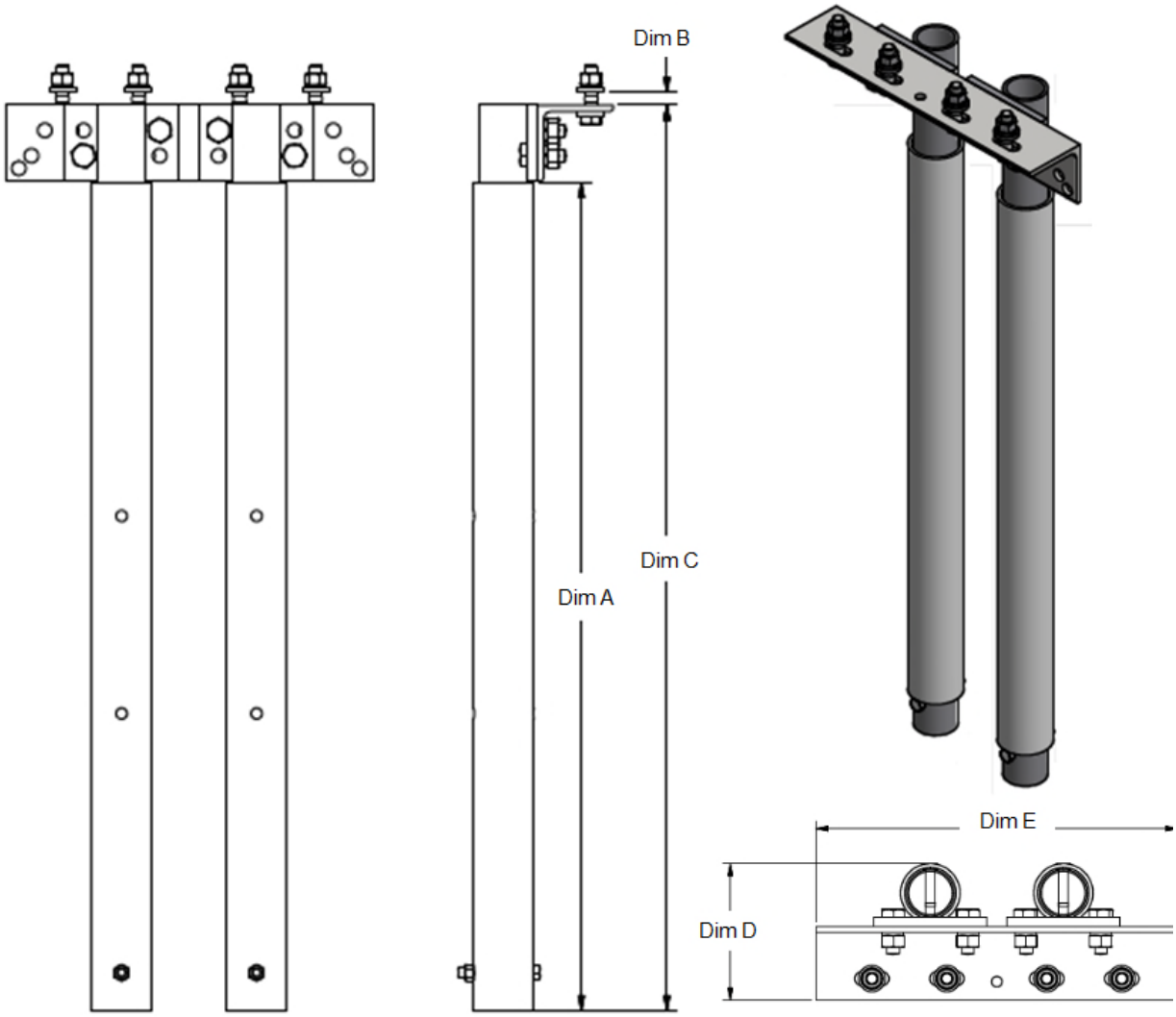


Horizontal Clevis/Rod Kit

Part Number	RLA000-01THRD	
Dim A	0.880-in	(22-mm)
Dim B	0.440-in	(11-mm)
Dim C	0.380-in	(10-mm)
Dim D	1.190-in	(30-mm)
Dim E	36.000-in	(914-mm)
Dim F	37.630-in	(956-mm)
Dim G	37.970-in	(964-mm)
Weight	1.4-lbm	(0.6-kg)
Attachment Hardware	3/8-inch	

Horizontal Lateral Braces

The Horizontal Lateral Brace, Part Number RLA000-01HLB are used in combination with the RLA000-01ALL Universal Horizontal Hanger Bracket to provide lateral support to the horizontal run of transmission line run while allowing expansion and contraction of both the vertical and horizontal run. They can be used with both Horizontal Vertical Spring Hanger and Horizontal Fixed Hangers and provide lateral support for the single point attachment configurations for both types. The Horizontal Lateral Brace spacing should be an average of every 240-inches (6,096-mm) for all rigid line sizes and types. If other lateral support is provided in the horizontal run by Horizontal Side Springs or Horizontal Clevis/Rod Kits, then a Horizontal Lateral Brace is not required.

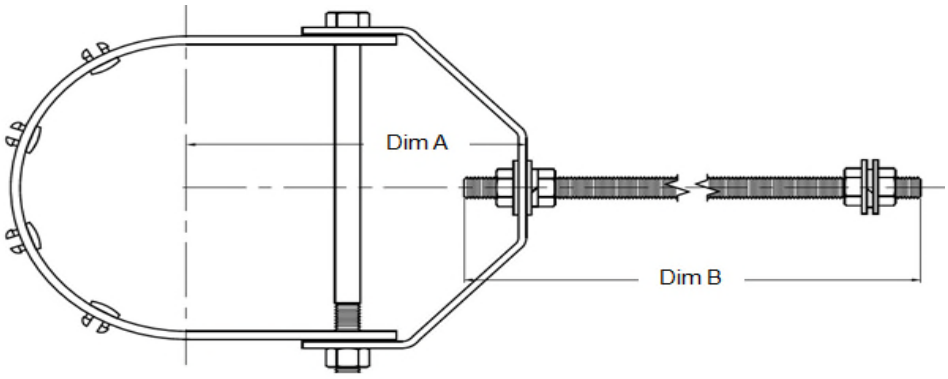


Horizontal Lateral Braces

Part Number	Dim A	Dim B	Dim C	Dim D	Dim E	Weight	Attachment Hardware
RLA000-01HLB	32.750-in (832-mm)	0.060 - 0.750-in (2 - 19-mm)	35.810-in (910-mm)	5.510-in (140-mm)	14.500-in (368-mm)	17.8-lbm (8.1-kg)	1/2-inch

Horizontal Slip Hangers

For indoor use only. Supports horizontal transmission line runs accommodates lateral motion due to expansion and contraction. Includes threaded rod and hardware to allow height adjustment.

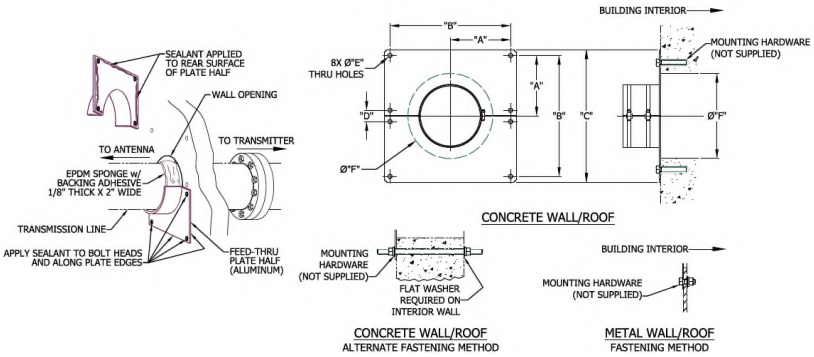


RLAx00-22A Horizontal Sliding Hanger

Horizontal Sliding Hangers

Part Number	Line Size	Dim A		Dim B		Weight		Attachment Hardware
RLA600B-22A	6-1/8-inch	6.940-in	(176-mm)	36.000-in	(914-mm)	3.8-lbm	(1.7-kg)	1/2-inch

Wall Roof Feed Thru Plates



Wall/Roof Feed Thru Plates are split aluminum plates that accommodate passage of a section of copper or aluminum rigid transmission line through the metal or concrete wall or roof of the transmitter equipment building. The two piece plate is supplied with EPDM weatherproofing sponge with backing and provides for proper weather sealing of the line to the building. Eight (8) (Four (4) in the RLA100-15) mounting holes are sized, refer to dimension "E" in table, for 3/8-inch or ½-inch mounting hardware (customer supplied).

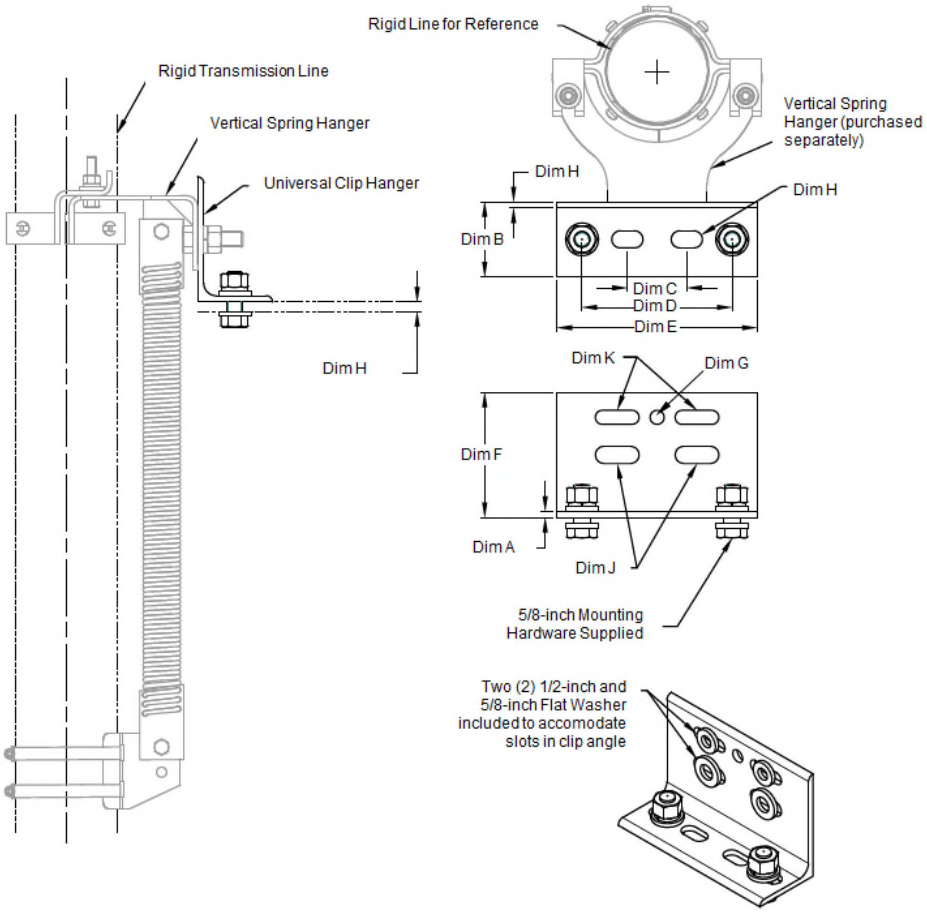
Accurately determine the entry point where the rigid line penetrates the structure. Cut out the designated area at the point of entry, refer to dimension “F” in table. Insert a single rigid line section through the entry opening. Complete both the exterior and interior installation of horizontal rigid line run. Ensure that the rigid line is suspended at the point of entry and not resting on either the top or bottom of the entry opening.

Wall/Roof Feed Thru Plates

Part Number	Line Size	Dim A	Dim B	Dim C	Dim D	Dim E	Dim F	Weight
RLA600-15A	6-1/8-inch	6.400-in (163-mm)	12.800-in (325-mm)	14.000-in (356-mm)	1.200-in (30-mm)	0.438-in (11-mm)	9.000-in (229-mm)	2.9-lbm (1.3-kg)

Horizontal Angle Member Rigid Line Hanger Attachment Bracket

Universal Rigid Line Hanger Attachment Bracket for 3-1/8-inch, 4-1/16-inch, 6-1/8-inch, 7-3/16-inch, 8-3/16-inch and 9-3/16-inch rigid transmission lines. Includes 5/8-inch hardware to attach to drilled or punched horizontal angle members. The mounting hardware supplied can accommodate thickness connection range from 0.06-inches to 0.50-inches. Spring hanger shown for reference only and is not included, order separately.



Universal Horizontal Angle Member Rigid Line Hanger Attachment Bracket

Part Number	RLA001-00KIT	
Dim A	0.250-in	(6-mm)
Dim B	3.000-in	(76-mm)
Dim C	2.380-in	(60-mm)
Dim D	6.000-in	(152-mm)
Dim E	8.000-in	(203-mm)
Dim F	5.000-in	(127-mm)
Weight	5.0-lbm	(2.3-kg)
Attachment Hardware	5/8-inch	

Dim G	0.563-in	(14-mm)
	1/2-inch mounting hardware	
Dim H	0.06 x 0.5-in	2 x 10-mm
	With One (1) Flat Washer	
	0.06 x 0.31-in	2 x 10-mm
	With Two (2) Flat Washers	
Dim J	0.69 x 1.75-in	18 x 40-mm
	slots for 5/8-inch mounting hardware	
Dim K	0.69 x 1.75-in	18 x 40-mm
	slots for 1/2-inch mounting hardware	

ERI Proposal Number: 20190810-396

Proposal

Submitted to:

Department of Administration
Purchasing Division
State of West Virginia
2019 Washington Street, East
Charleston, WV 25305-0130

by:

Electronics Research, Inc.

Bill Harland
Vice President of Marketing

Telephone: +1 (812) 925-6000 Ext. 214 (office)
+1 (812) 455-1823 (cell)
Email: bharland@eriinc.com

This document includes pages 98 of 112 and is governed by the terms and conditions contained herein. Upon customer acceptance, order is subject to final review and written acceptance by ERI at our main business office. Unless otherwise stated in the body of this quotation, freight charges are not included and will be added to the final invoice. Also, unless listed separately in the body of this quotation, prices do not include any state, local, or other taxes or duties.

Proposal Number: 20190810-396

Date: August 14, 2019
Valid Through: September 13, 2019
FOB Destination

Reference: CRFQ EBA2000000004 High Power UHF Television Transmit Antenna WNPB-TV

Payment Terms: per Bid Specifications

Please **complete** the Purchaser's Acceptance block, **scan** this document along with your deposit check and **e-mail** to: peggy@eriinc.com or **FAX** to: 812-925-4030. Please **remit** down payment to the address below, attn: Accounts Receivable.

Purchaser's Acceptance:

Please accept our order for the products and services contained in this proposal.

Signature:_____

Name:_____

Title:_____

P.O. Number:_____

Item	Qty	Part #	Description	Unit Price	Extended
001	1	ATW21H4-ETC170-34H	Top Mounted Elliptically Polarized UHF TRASAR® Television Transmitting Antenna ERI Model ATW21H4-ETC170-34H top mounted, elliptically polarized UHF TRASAR® television antenna for RF Channel 34 (590 to 596 MHz). Rated for 48 kW Average Power, 8VSB input power. 6-1/8-inch EIA, 75 Ω, flanged male RF input. Described in ERI Preliminary Specification _____ dated _____. Price does not include tower top plate interface. Note(s): 1. Fill in final approved specification number and date prior to submitting ERI's signed Proposal (Purchaser's Acceptance, page 1 of Proposal Document).	213,320.00	213,320.00
002	29	MACX675B-3	6-1/8-inch, 75 ohm, 19.5 foot MACXLine section, flanged both ends, supplied with bellows, captivated inner connector, and flange hardware kit. Price shown is **per foot** Vertical Run: 440 (feet) Horizontal Run: 132 (feet)	2,021.00	58,609.00
003	4	MACX675B-5	6-1/8-inch, 75 ohm, customer specified length, up to 60-inches, MACXLine section, flanged both ends, supplied with inner connector, and EIA flange hardware kit. Specify flange to flange length of outer conductor in inches (two decimal places): _____ inches.	1,047.00	4,188.00
004	1	MACX675B-10	6-1/8-inch, 75 ohm, customer specified length, from 60-inches to 120-inches, MACXLine section, flanged both ends, supplied with bellows, captivated inner connector, and flange hardware kit. Specify flange to flange length of outer conductor in inches (two decimal places): _____ inches.	1,300.00	1,300.00
005	11	ACX675B-10SU	6-1/8-inch, 75 ohm, 90 degree miter elbow (unequal legs), captivated inner conductor, includes inner connector, 'O' ring, silicone grease, and flange hardware kit.	1,613.00	17,743.00
006	2	ACX675-20	6-1/8-inch, 75 ohm standard inner connector.	205.00	410.00
007	1	RLA675-16	6-1/8-inch, 75 ohm, heavy duty gas barrier, both sides have a pressure port, fixed male inner connectors both ends.	1,504.00	1,504.00

Item	Qty	Part #	Description	Unit Price	Extended
008	2	RLA600-13-2	6-1/8-inch Vertical Rigid Hanger. Use at tower top minimum of two required for up to 500 feet of vertical line. Mounting hardware included: 5/8-inch diameter hardware for mounting to 11/16 inch diameter hole. Two (2) hangers, mounted 10-feet (3.0 meters) apart will support a 500-foot vertical run of 6-1/8-inch rigid line. Add one (1) hanger for each additional 500-feet of vertical run length. Price shown is for one piece. Stainless steel.	200.00	400.00
009	39	RLA600-11-H	6-1/8 inch hinged Vertical Spring Hanger, supports the transmission line, prevents lateral motion, and accommodates differential expansion and contraction. Use at 10 foot intervals. Includes 5/8-inch mounting hardware.	230.00	8,970.00
010	2	RLA000-01VLB	Rigid transmission line vertical lateral brace for 3-1/8, 4-1/16, 6-1/8, 7-3/16 and 8-3/16-inch rigid transmission lines, restricts lateral motion while allowing vertical and horizontal line movement. Use two (2) braces at bottom of vertical run, equally spaced above the elbow at the base of the vertical run and the lowest vertical sliding hanger or vertical spring hanger. Includes 1/2-inch mounting hardware.	375.00	750.00
011	3	RLA000-01HLB	Rigid transmission line horizontal lateral brace for 3-1/8, 4-1/16, 6-1/8, 7-3/16 and 8-3/16-inch rigid transmission lines, restricts lateral motion while allowing vertical and horizontal line movement. Use at 240-inch intervals along the horizontal run. Includes 1/2-inch mounting hardware.	395.00	1,185.00
012	41	RLA001-00KIT	Universal Rigid Line Bracket for 3-1/8-inch, 4-1/16-inch, 6-1/8-inch, 7-3/16-inch, 8-3/16-inch, and 9-3/16-inch rigid transmission lines. Includes 5/8-inch hardware to attach to drilled or punched horizontal angle members.	41.00	1,681.00
013	4	RLA000-01VSCU	Horizontal Spring Hanger for RLA000-01ALL creates a single point horizontal spring hanger for copper outer conductor 3-1/8, 4-1/16, 6-1/8, 7-3/16 and 8-3/16-inch rigid transmission lines. Use with RLA000-01HLB to restrict lateral motion or add two (2) RLA000-01HS Horizontal Side Springs.	92.00	368.00
014	2	RLA000-01THRD	Horizontal Rigid Hanger for RLA000-01ALL creates a single point horizontal rigid hanger for 3-1/8, 4-1/16, 6-1/8, 7-3/16 and 8-3/16-inch rigid transmission lines. Use with RLA000-01HLB to restrict lateral motion or add a second RLA000-01THRD to create a two-point horizontal rigid hanger.	65.00	130.00

Item	Qty	Part #	Description	Unit Price	Extended
015	6	RLA000-01ALL	Rigid transmission line horizontal hanger bracket assembly for 3-1/8, 4-1/16, 6-1/8, 7-3/16 and 8-3/16-inch rigid transmission lines.	95.00	570.00
016	1	RLA600-15A	6-1/8-inch Wall Feed Thru, includes split mounting plate. Aluminum with EPDM weatherproofing sponge with backing. Uses 3/8-inch mounting hardware (not supplied).	366.00	366.00
017	2	RLA600-21	6-1/8-inch hardware kit, includes 'O' ring, silicone lubricant, nuts, bolts, and lock washers for one flange joint.	27.00	54.00
018	2	RLA600B-50	6-1/8-inch end cap to seal line.	303.00	606.00
019	2	STD675B-FT	6-1/8-inch, 75 ohm, UHF fine matcher, flanged both ends. Includes one captive inner connector and flange hardware kit. 7 tuners, 18-inch length. Pressurizable, with caps over tuning screws. Tuners including locking nuts and pressure tight caps. Does not include mounting brackets or hardware. These are available from ERI at additional cost.	3,018.00	6,036.00
020	1	ACX675B-17-34	6-1/8-inch impedance transformer, 75-ohm to 50-ohm includes 50 ohm inner connector and one flange hardware kit. Channel 34.	1,613.00	1,613.00
021	8	RLA600B-22A	6-1/8-inch horizontal slip hanger for indoor use, stud mounted.	139.00	1,112.00
022	1	TST-001	TV System Sweep (Tune and Test) One (1) ERI Technician to field match television antenna after installation. Price includes travel, local living expense, and daily field service rate for one (1) day on site. ERI field service price includes a single (per project) mobilization and indicated number of days on site, for one person. Additional days if required will be charged for at the rate of $2,100.00 per day. Price includes test equipment usage. Field service prices are net to ERI and not discountable. Customer to provide tower crew to assist antenna field matching. Price valid for the location within the contiguous forty-eight (48) United States only. Contact ERI for pricing in other locations.	6,250.00	6,250.00

Item	Qty	Part #	Description	Unit Price	Extended

Total Price	$327,165.00
Net Package Price	$291,440.00
Material Freight	$6,800.00
Grand Total	$298,240.00

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Chandler, IN 47610-9219
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+1 812 925-4030 (fax)
877 ERI-LINE (toll-free)

Sales@eriinc.com
CustomerSupport@eriinc.com
www.eriinc.com

Purchaser Information Page

Mail to Address:

Name:	
Company:	Department of Administration, Purchasing Division State of West Virginia
Address:	2019 Washington Street, East
City, ST, ZIP:	Charleston 25305-0130 WV
Country:	
Phone:	
FAX:	
E-Mail:	

Ship to Address:

Name:	Art Austin
Company:	WV Educational Broadcasting Authority WNPB-TV Transmitter Site
Address:	2095 Sand Springs Road
City, ST, ZIP:	Morgantown 26508 WV
Country:	
Phone:	
FAX:	
E-Mail:	

Submit to Address:

Name:	
Company:	Department of Administration, Purchasing Division State of West Virginia
Address:	2019 Washington Street, East
City, ST, ZIP:	Charleston 25305-0130 WV
Country:	
Phone:	
FAX:	
E-Mail:	

Consultant Address:

Name:	
Company:	
Address:	
City, ST, ZIP:	
Country:	
Phone:	
FAX:	
E-Mail:	

Ship Via:
ERI selected method, unless otherwise specified.

Special Shipping Method:
ERI designated trucks. Fuel surcharge may apply at time of shipment. Freight for customer specified special lengths of rigid line not included in freight cost. Freight cost for special cuts will be additional.

Final CP Received? Yes

Comments:

Terms and Conditions of Sale

1. Applicable to All Orders

1.1 Acceptance of Proposal: When the Proposal is signed by Buyer, returned to Electronics Research, Inc. (hereinafter called "ERI"), and accepted by ERI at its offices in Chandler, Indiana, USA, the Proposal shall become a binding agreement for the purchase by buyer from ERI of the Products and/or Services described therein, upon the terms specified, including these Terms and Conditions of Sale, attached to the Proposal. Refundable deposits are charged for some skids and large size cable reels. All orders are subject to a minimum charge of $50.00 net.

1.2 Acknowledgement of Terms: By signing the Proposal, Buyer represents and acknowledges that it has fully read, understands, and accepts the terms of the Proposal, including these "Terms and Conditions of Sale" included therein, that the Proposal contains the complete and final agreement of Buyer and ERI with respect to the Products and/or Services described therein; that all other agreements, representations, and warranties, whether oral or in writing, made prior to or at the time of the signing of the Proposal, are merged and replaced therein; and that no change or addition to the Proposal shall be valid and enforceable unless made in writing and signed by an authorized representative of ERI.

1.3 Buyer's Terms and Conditions: ERI desires to provide its customers with prompt and efficient service. However, to negotiate individually the terms and conditions of each sales contract would substantially impair ERI's ability to provide such service. Accordingly, Products and Services furnished by ERI are sold only on the terms and conditions stated herein, any terms or conditions on Buyer's order to the contrary notwithstanding. ERI's performance of any contract is expressly made conditional on Buyer's agreement to ERI's Terms and Conditions of Sale unless otherwise specifically agreed to, in writing, by ERI. In the absence of such agreement, commencement of performance and/or delivery shall be for Buyer's convenience only and shall not be deemed or construed to be acceptance of Buyer's terms and conditions. If a contract is not earlier formed by mutual agreement, in writing, acceptance of any Product or Service shall be deemed acceptance of the terms and conditions stated herein. In the case of a conflict between the terms and conditions stated herein and those appearing on the face of this Proposal, the latter shall control. All contracts for the sale of Products and/or Services shall be construed under and governed by the laws of the State of Indiana, the location of ERI's primary manufacturing facilities and its corporate headquarters.

1.4 Conditions of Proposal: ERI's Proposal is subject to the following:

1.4.1 The Buyer warrants that all information supplied by it to ERI for the preparation by ERI of the Proposal, including oral and written correspondence, reports, plans, and specifications are adequate, accurate, workable, and practicable of design, and, if the supplied information is followed, a sufficient and satisfactory result will be achieved. Buyer shall be responsible for all costs incurred by ERI by reason of any inaccurate or incomplete information supplied by Buyer.

1.4.2 Unless otherwise stated in the Proposal, the Buyer is responsible for obtaining any necessary permits and/or approvals (FCC, FAA, local, etc.) needed to install and use the Products included in the Proposal. If the Proposal includes Installation Services, the necessary permits must be obtained prior to mobilization.

1.4.3 UNLESS OTHERWISE SPECIFIED, IN WRITING, ALL PROPOSALS ARE FIRM FOR, AND EXPIRE, THIRTY (30) DAYS AFTER DATE THEREOF AND CONSTITUTE OFFERS, provided, however, that budgetary Proposals and estimates are for preliminary information only and shall neither constitute offers, nor impose any responsibility or liability upon ERI.

1.4.4 Unless otherwise stated in writing by ERI in the Proposal, all prices in a Proposal shall be exclusive of transportation, insurance, taxes (including, without limitation, any sales, use or similar tax, and any tax levied on or assessed to ERI after Product delivery by reason of ERI's security interest in Products), license fees, customs fees, duties and other charges related thereto, and Buyer shall report and pay any and all such shipping charges, premiums, taxes, fees, duties and other charges related thereto, and shall hold ERI harmless there from, provided, however, that if ERI, in its sole discretion, chooses to make any such payment, Buyer shall reimburse ERI in full upon demand.

1.4.5 Stenographical, typographical and clerical errors contained in the Proposal are subject to correction.

1.4.6 Prices set forth in a Proposal are for Products and/or Services only and do not include technical data, proprietary rights of any kind, patent rights, qualification, environmental or other than ERI's standard product performance tests, and other than ERI's normal domestic commercial packaging, unless expressly agreed to in writing by ERI.

1.4.7 Published weights and dimensions are approximate only. Certified dimension drawings can be obtained upon request. Manuals, programs, listings, drawings, or other documentation required hereunder must be referenced specifically.

1.5 Terms of Payment: Unless otherwise stated in the Proposal, payment is due upon delivery. All payments for Products released and shipped on approved credit accounts shall be due in upon receipt of invoice therefore. Past due balances shall be subject to a late charge of 1.8% per month. Partial shipments will be billed as made and payments therefore are subject to the above terms. Payment shall not be withheld for delay in delivery of required documentation unless a separate price is stated therefore, and then only to the extent of the price stated for such undelivered documentation. ERI may cancel or delay delivery of Products in the event Buyer fails to make prompt payment therefore or in the event of an arrearage in Buyer's account with ERI.

1.6 Performance: ERI will make all reasonable effort to observe its dates indicated for delivery or other performance. However, ERI shall not be liable in any way because of any delay in performance hereunder due to acceptance of prior orders; technical difficulties; strike; lockout; riot; war; fire; act of God; accident; failure or breakdown of components necessary to complete an order; subcontractor, supplier or Buyer caused delays; inability to obtain or constrain substantial rises in the price of labor, materials or manufacturing facilities; curtailment of or failure to obtain sufficient electrical or other energy supplies; or compliance with any law, or regulation or order, whether valid or invalid, of any cognizant governmental body or any instrumentality thereof now existing or hereafter created; or due to any unforeseen circumstances or causes beyond ERI's control, provided such delay is neither material nor indefinite. ERI's performance shall be deemed suspended during and extended for such time as it is so delayed, and thereafter Buyer shall accept performance hereunder. Delay in performance shall not be considered material or indefinite unless it exceeds or is reasonably estimated by ERI to exceed a period of six (6) months. ERI reserves the right, in its sole discretion, to allocate inventories and current production and substitute suitable materials when, in its opinion, such allocation or substitution is necessary due to such circumstances or causes in the interest of conservation of scarce materials and efficient utilization of high value parts and components. ERI's products may contain remanufactured parts and components. Such parts and components are covered by the same warranty and are subject to the same high standards of quality control applied to other parts and components. No penalty clause for delay in performance contained in any Buyer-originated documents of any kind shall be effective. As used herein, "performance" shall include, without limitation, fabrication, shipment, delivery, assembly, installation, testing and warranty repair or replacement, as applicable.

1.7 Change Orders: Buyer change orders must be in writing and no change shall be made pursuant to this clause unless agreed to in writing and signed by duly authorized representatives of ERI and Buyer. If any such change causes an increase or decrease in the cost or the time required for the performance of any part of the work, an equitable adjustment shall be made in the contract price and schedule. ERI shall have no obligation to commence any extra or changed work without written agreement as to adjustments to contract price and delivery schedules affected thereby.

1.8 Assignments and Terminations: Any assignment by Buyer of any contract created by the Proposal without the express written consent of ERI is void. No order may be terminated by Buyer except by mutual agreement in writing. Terminations by mutual agreement are subject to the following conditions: (a) Buyer will pay, at applicable contract prices, for all Products which are completely manufactured and allocable to Buyer at the time of ERI's receipt of a request for mutual termination; (b) Buyer will pay all costs, direct and indirect, which have been incurred by ERI with regard to Products which have not been completely manufactured at the time of ERI's receipt of a request for mutual termination, plus a pro rata portion of normal profit on the contract; (c) Buyer will pay a termination charge on all other Products affected by the termination. (d) Orders for standard catalog products may be canceled prior shipment, however any order that has been cut, filled or packaged prior to Seller's receipt of cancellation notice shall be subject to a 20% re-stocking charge. (e) Orders for non-standard products or specially manufactured products may be canceled prior to the start of manufacture provided Buyer reimburses ERI for any actual costs incurred on the order prior to the effective cancellation date. After manufacture commences, orders for non-standard products or specially manufactured products may not be canceled. In the event Buyer terminates such orders, Buyer shall be liable to ERI for termination charges, including, but not limited to, reasonable profits. ERI's normal accounting practices shall be used to determine costs and other charges. To reduce termination charges, ERI will divert completed parts, material or work in process from terminated contracts to other Buyers whenever, in ERI's sole discretion, it is practicable to do so.

1.9 Damage and Liability: ERI'S AGGREGATE LIABILITY IN DAMAGES OR OTHERWISE SHALL NOT EXCEED THE PAYMENT, IF ANY, RECEIVED BY ERI FOR THE UNIT OF PRODUCT OR SERVICE FURNISHED OR TO BE FURNISHED, AS THE CASE MAY BE, WHICH IS THE SUBJECT OF CLAIM OR DISPUTE. IN NO EVENT SHALL ERI BE LIABLE FOR INCIDENTAL, CONSEQUENTIAL, LIQUIDATED, OR SPECIAL DAMAGES, HOWSOEVER CAUSED. Liability to third parties for bodily injury, including death, resulting from ERI's performance shall be determined in accordance with applicable law and shall not be affected by the liability limitations stated above in this paragraph.

1.10 Disputes: All disputes under any contract concerning Products and/or Services not otherwise resolved between ERI and Buyer shall be resolved in a court of competent jurisdiction in the County of Warrick in the State of Indiana or the United States District Court for the Southern District of Indiana, Evansville Division, and in no other place. Provided, that in ERI's sole discretion,

such action may be heard in some other place designated by ERI if necessary to acquire jurisdiction over third persons so that the dispute can be resolved in one action. Buyer hereby consents to the jurisdiction of such court or courts and agrees to appear in any such action upon written notice thereof. No action, regardless of form, arising out of, or in any way connected with, the Products or Services furnished by ERI, may be brought by Buyer more than one (1) year after the cause of action has occurred. If any part, provision or clause of these `Terms and Conditions of sale, or the application thereof to any person or circumstances, is held invalid, void or unenforceable, such holding shall not affect and shall leave valid all other parts, provisions, clauses or applications of these Terms and Conditions remaining, and to this end these Terms and Conditions shall be treated as severable.

1.11 General Conditions:

1.11.1 No delay or failure on the part of ERI in exercising any right or remedy under any contract resulting from, and/or partial or single exercise thereof, shall constitute a waiver of such right or any other remedy. ERI's rights and remedies under any contract resulting here from are cumulative and not alternative.

1.11.2 If any term of any contract resulting here from or the application thereof shall be illegal, such illegality shall not affect any other term or condition thereof, and such shall continue in full force and effect.

1.11.3 Any contract resulting here from shall be binding upon the heirs, personal representative, successors and permitted assigns of the parties.

2. Applicable to Orders for Products

2.1 Transportation and Risk of Loss: Transportation will normally follow Buyer's shipping instructions, but ERI reserves the right to ship Products freight collect and to select the means of transportation and routing when Buyers instructions are deemed unsuitable in ERI's judgment. Unless otherwise advised, ERI may, but shall be under no obligation to, insure to full value of the Products or declare full value thereof to the transportation company at the time of delivery, and all freight and insurance costs shall be for Buyer's account. Risk of loss and/or damage shall pass to Buyer upon delivery of the Products to the transportation company at the FOB point whether or not installation is provided by or under supervision of ERI. Confiscation or destruction of, or damage to Products shall not release, reduce or in any way affect the liability of Buyer therefore. Notwithstanding any defect or nonconformity, or any other matter, such risk of loss and/or damage shall remain in Buyer until the Products are returned at Buyer's expense to such place as ERI may designate, in writing. Buyer, at its expense, shall fully insure Products against all loss and/or damage until ERI has been paid in full or the Products have been returned for whatever reason to ERI. All Products must be inspected upon receipt and claims should be filed with the transportation company when there is evidence of shipping damage, either concealed or external. As used in the clauses appearing herein or attached hereto, "delivery" shall occur when the Product is delivered at the FOB point which shall be the point of manufacture or such other place as ERI shall specify, in writing, notwithstanding installation by or under supervision of ERI.

2.2 Acceptance: The shipment by ERI of a Product to the Buyer shall constitute acceptance of that Product by Buyer, unless notice of defect or nonconformity is received by ERI within thirty (30) days of receipt of the Product at Buyer's designated receiving address, provided, that for Products for which ERI agrees, in writing, to perform acceptance testing after installation, the completion of ERI's applicable acceptance test, or execution of ERI's acceptance form by Buyer, shall constitute acceptance of the Product by Buyer. Notwithstanding the foregoing, any use of a Product by Buyer, its agents, employees, contractors or licensees, for any purpose, after receipt thereof, shall constitute acceptance of that Product by Buyer. ERI may repair or, at its option, replace defective or nonconforming parts after receipt of notice of defect or nonconformity.

2.3 Shipment Delays/Billing in Place: Upon completion of Buyer's order, any delay in shipment attributable to Buyer, including, but not limited to, Buyer's request to defer the delivery date, shall cause the following to occur: Thirty (30) days after the original shipment date, a storage charge of 1½% of the invoice price per month will be billed to Buyer and title to the shipment will automatically pass to Buyer. ERI will invoice Buyer for completed goods and Buyer will pay in accordance with the terms of the original sale, as the goods will be deemed to have shipped in place. ERI will insure against risk of loss until physical shipment of the goods to a common carrier. A tower shipment date is contingent upon receipt by ERI of all necessary site specific information. This information must be included with the signed Proposal and tower order. Depending upon the nature of the project, site specific information may include, but is not limited to: a site survey showing plot dimensions, topography, and possible obstructions; a geotechnical report; the desired tower orientation; the desired antenna orientation; and a complete shipping address.

2.4 Returns: Standard catalog products may be returned for credit provided such products are returned within six (6) months after the original shipment date. The minimum value accepted for return from each purchase order is $50.00. The amount of credit issued for any returned product shall be determined solely by ERI based on the resalable condition of the product. Non-standard products, including products specially manufactured in accordance with Buyer's specifications or tuned to one or more specified operating frequencies may not be returned for credit. Buyer shall obtain ERI's written return goods authorization prior to returning any Product for credit.

2.5 Service Warning: The Products may be dangerous if improperly installed, handled, serviced, refurbished, or reinforced. In the event that repair, maintenance or servicing need to be performed on the Products, Buyer should contact ERI immediately. ERI shall not be liable for any damages or injuries occurring in connection with maintenance, servicing or repair work on the Products done by persons other than ERI or its duly authorized representatives.

2.6 Installation: Unless this Proposal includes installation services, Buyer is responsible for installation of the Products, including preparation and maintenance of all Products, materials, or services necessary for the operation of the Products not provided by ERI. All installations should be performed by qualified tower climbers and electricians. All OSHA, state and local safety regulations should be observed. Any photos or drawings in product literature, installation manuals, or drawings are used to illustrate a specific point and are not intended to supersede any OSHA, state or local safety regulations.

2.7 Patents and Other Intellectual Property Rights: ERI will, at its own expense and as set forth herein, defend any action brought against Buyer in respect to any claim that the design or manufacture of any Product in ERI's commercial line of Products or manufactured to specifications set by ERI and furnished hereunder, constitutes an infringement of any patents or other intellectual property rights of the United States. Subject to the provisions in the DAMAGES AND LIABILITY section hereof, ERI will pay all damages and costs either awarded in a suit or paid, in ERI's sole discretion, by way of settlement, which are based on such claim of infringement, provided, that Buyer promptly notifies ERI, in writing, of such claim or infringement and gives ERI full authority, information and assistance in settling or defending such claim, or ERI will, in its sole discretion and at its own expense, either procure a license which will protect Buyer against such claim without cost to Buyer, replace said Product with a non-infringing Product or remove said Product and refund an equitable portion of the price paid by the Buyer to ERI for said Product. ERI shall have no liability whatsoever hereunder with respect to any claims settled by Buyer without ERI's prior written consent. ERI EXPRESSLY EXCLUDES from any liability hereunder, and Buyer shall hold ERI harmless from and against, any expense, loss, costs, damages or liability resulting from claimed infringement of patents, trademarks, copyrights or other intellectual property rights: (a) arising from a use of or a combination of a Product with other equipment, processes, programming applications or materials not furnished under the Proposal; (b) based on items made with the Products furnished under the Proposal; (c) arising out of compliance by ERI with Buyer's designs, specifications or instructions; and/or (d) arising from use or manufacture by anyone of inventions in connection with Products or services sold, used or intended for sale or use in performing contracts with the United States or related subcontracts. The foregoing states ERI's entire liability for any claim based upon or related to any alleged Infringement of any patent or other intellectual property rights.

2.8 Standard Two (2) Year Product Limited Warranty: Electronics Research. Inc. (ERI) warrants to the original Buyer that its Product is free from defects in material or workmanship

2.8.1 existing at the time of shipment from the factory or

2.8.2 that develop under normal use in a properly installed and maintained system for a period of twenty-four (24) months following the date of shipment, ex-works.

2.8.3 ERI Exclusions: Expressly excluded from the terms of this limited warranty are defects caused by:

2.8.3.1 faulty installation;

2.8.3.2 all minor system leakage ("leakage" is defined in paragraph 2.8.15), below);

2.8.3.3 equipment leaks and detuning if caused by rough handling or installation;

2.8.3.4 lack of proper inspection and maintenance;

2.8.3.5 unusually severe weather, lightning, icing, acts of God; such events require inspection for, and correction of, such damage;

2.8.3.6 water intrusion, foreign materials in the system;

2.8.3.7 vandalism, physical abuse, tampering, or unauthorized disassembly, repair or modification without explicit written approval of ERI;

2.8.3.8 operation not in accordance with published ratings, specifications, or instructions.

2.8.4 ERI Products are delivered Ex-Works. Unless ERI supervises the transportation, delivery, and/or installation of the product, ERI is not responsible for damage that may result from incorrect or improper transportation, storage, handling or installation of Products.

2.8.5 Buyer shall regularly inspect and maintain all ERI manufactured parts and Resale parts in accordance with ERI's and/or manufacturer's inspection and maintenance guidelines and in accordance with all regulations and recommendations of any government agency or body and in accordance with generally accepted industry maintenance standards. An initial inspection shall be conducted promptly after installation to verify that the installation is properly performed in accordance with ERI's and/or the manufacturer's installation instructions and procedures. Such inspections shall be performed at Buyer's expense by qualified personnel, and inspection summary report(s) shall be prepared immediately upon inspection completion. Reports of initial inspections shall be submitted to ERI Customer Service. Buyer shall forever protect, defend, indemnify, and hold ERI free and harmless against all claims, demands, liabilities, cause of action (including, without limitation, legal costs and expenses and reasonable attorney's fees) arising out of, or relating to Buyer's failure to completely discharge its obligations hereunder.

2.8.6 Buyer shall follow promptly all recommendations from qualified inspectors and/or ERI regarding the maintenance of all ERI manufactured and Resale structural Products.

2.8.7 Upon making a warranty claim, make copies of all preceding inspection reports and dispositions available to ERI for review.

2.8.8 Any defective warranted component of an ERI product will be repaired or replaced at the place of manufacture, ex-works, without charge if all defective components are returned by the Buyer to ERI, and ERI inspection discloses that such defects are as reported and are not the result of ERI Exclusions.

2.8.9 Under some circumstances, continuity of service may necessitate immediate shipment of repair parts before ERI inspection of defective parts. Under these conditions, ERI requires that Buyer place an order for replacement parts and will require that all defective parts be packaged and returned for factory inspection and determination of warranty status. If failure is determined to be covered by this warranty, credit will be issued for parts ordered by Buyer to expedite replacement.

2.8.10 Other than the replacement of defective Products or components ex-works, ERI shall not be responsible for any costs or expenses incurred by the Buyer arising from the identification, removal, and replacement of defective products.

2.8.11 ERI, at its sole discretion, may choose to supply warranty parts for repairs on site. In such cases, materials shall be shipped free of additional charge to the site. Losses arising from repair or replacement activities, including those for delays, rigging, and additional installation or maintenance crew time, are not be covered under this warranty.

2.8.12 Warranty repairs/replacements, whether at factory or on site, will fulfill the term of the original warranty. No extension of the original warranty term will be allowed.

2.8.13 "Resale equipment/parts/components" are defined as equipment, parts, or components purchased from another manufacturer or supplier and resold by ERI, shall only carry such manufacturer's or supplier's standard warranty in effect at the time of Product shipment from the supplier.

2.8.14 Antenna warranties shall be void if Buyer does not (i) purge and pressurize the antenna system with dry nitrogen or dry air furnished by the Buyer immediately following the installation of the system to initially check for installation leaks and (ii) maintain the antenna under a positive pressure of approximately 2 to 5 pounds per square inch at all times, including prior to installation, using either dry nitrogen or dry air. This warranty is void in the event that the system is pressurized above ERI's published instructions.

2.8.15 Minor leakage in a large system can be difficult if not impossible to detect, especially since temperature variations can mask their extent. ERI recommends the installation of dehydration equipment in any significant pressurized system. Minor leakage is beneficial because it causes occasional cycling the dehydration equipment and provides a fresh purge to the system. ERI regards any leak resulting in a system pressure drop of 0.5 PSI per day or less, temperature compensated, as an acceptable leak rate not actionable under these warranty terms.

2.8.16 For the scope and purposes of this warranty with regard to ERI manufactured structural towers/parts and resale structural parts, the phrase "Current Standard" is defined as the most current revision of ANSI/TIA-222 Standard including, but not limited to, all relevant appendices and annexes thereof, and all relevant documents incorporated by reference there from. This warranty shall be void if the Buyer does not:

2.8.16.1 follow all relevant and applicable directives as set forth in the Current Standard;

2.8.16.2 consult and obtain explicit approval from ERI regarding the qualifications of the tower crew chosen to implement/install any structural repairs and/or modifications;

2.8.16.3 consult and obtain explicit approval from ERI prior to implementing changes to the structure serviceability requirements, structure classification, and/or tower appurtenance loading (such as antennas, transmission lines, mounts, ice shields, platforms, ladders, etc.) which varies significantly from the original design parameters as determined by ERI.

2.8.17 Adequate VSWR monitoring and protection equipment must be installed and properly maintained in the transmission system to prevent system damage from ice, lightning, and other natural phenomena. Failure to properly install, maintain, or observe the warnings of the VSWR protection equipment voids this warranty, and subsequent damage caused by such failure is not covered under this warranty. ERI recommends purchase of an ERI manufactured or approved VSWR protection unit at time of antenna purchase.

2.8.18 If warranty site service is requested, it will be provided pursuant to a Buyer issued purchase order. If defects are not found to be the result of a valid warranty claim an invoice for such service will be issued at prevailing rates.

2.8.19 Notification of warranty claim must be provided to ERI within 30 days of the triggering event or detection of the failure.

2.8.20 In no case may the value of the warranty claim exceed the purchase price of the Product.

2.8.21 Warranty services will be provided, and valid claims will be honored as long as Buyer is current on all accounts due and owing to ERI.

2.8.22 The foregoing warranty is and shall be In lieu of all other warranties, express or implied, including any implied warranty of merchantability and any implied warranty of fitness for a particular application or purpose. There are no warranties, representations of fact, or promises with respect to signal coverage or strength.

2.8.23 Under no circumstances shall ERI be obligated or liable for special incidental, indirect, consequential or other damages, losses, or expenses in connection with or by reason of the foregoing warranty or by reason of some other type of express or implied warranty found to exist notwithstanding the foregoing disclaimers.

2.9 Warranty Replacement and Adjustment: All claims under warranty must be made promptly after occurrence of circumstances giving rise thereto and must be received within the applicable warranty period by ERI or its authorized representative. Such claims should include the Product type and serial numbers and a full description of the circumstances giving rise to the claim. Before any Products are returned for repair and/or adjustment, written authorization from ERI or its authorized representative for the return and instructions as to how and where such Products should be shipped must be obtained. Any Product returned to ERI for examination shall be sent prepaid via the means of transportation indicated as acceptable by ERI. ERI reserves the right to reject any warranty claim not promptly reported and any warranty claim on any item that has been altered or has been shipped by non acceptable means of transportation. When any Product is returned for examination and inspection, or for any other reason Buyer shall be responsible for all damage resulting from improper packing or handling, and for loss in transit notwithstanding any defect or non conformity in the Product. In all cases ERI has sole responsibility for determining the cause and nature of failure, and ERI's determination with regard thereto shall be final. If it is found that ERI's Product has been returned without cause and is still serviceable, Buyer will be notified and the Product returned at its expense; in addition, a charge for testing and examination may, in ERI's sole discretion, be made on Products so returned.

2.10 General Conditions:

2.10.1 ERI reserves the right to change or modify its design and construction of the Products and/or to substitute materials equal to or superior to or functional equivalents to that originally specified herein provided, however, that any substitution, change or modification shall not materially and adversely affect Buyer's ability to use the Products.

2.10.2 ERI reserves the right to make changes in design and construction of the Products it manufactures for others and to make and/or add improvements in such Products at any time without incurring any obligation to install the same in the products sold herein.

2.10.3 The Buyer shall at its expense engage any qualified engineer necessary to approve ERI's design, obtain building permits, and insure structural integrity of existing structure considering any ERI addition or appurtenance unless otherwise specified in the Proposal. ERI shall furnish construction and installation drawings and engineering data for its Products upon request.

2.10.4 The Proposal is submitted in accordance with the ANSI/EIA/TIA-222 standard in effect as of the date of the Proposal, unless otherwise stated in the body of the Proposal. This standard is intended to set the minimum criteria for the structural design, fabrication and construction of antennas and antenna support structures. It is the responsibility of the Buyer to provide site specific data and design requirements and any requirements differing from those contained in this standard to ERI prior to accepting the Proposal. Please refer to the applicable edition of the ANSI/EIA/TIA-222 standard for further information.

2.10.5 Buyer is responsible for any and all disposal and recycling of Products, packaging, reels, shipping crates, and other items associated with the fulfillment of order, as well as for compliance with any mandated "green" initiatives.

2.10.6 If field services are provided Buyer may request to be named as an additional insured on ERI's Liability policy and be provided a Certificate of Insurance naming Buyer as a certificate holder.

3. Special Terms and Conditions Applied to Field and Installation Services

3.1 If ERI is not the current Engineer of Record (EOR) for the supporting structure, it shall be the Purchaser's responsibility to engage the current structure's EOR or a Qualified Engineer to review all Construction Class IV work activities to assess construction loads at rigging attachment points and/or work activities impacting the strength and stability of the supporting tower such as structural member replacements in direct accordance with the current ANSI/TIA-322, Loading, Analysis, and Design Criteria Related to the Installation, Alteration and Maintenance of Communication Structures. ERI shall retain the services of a Supervising Engineer to develop construction loads which will be provided to the Purchaser, or their named representative, along with specific rigging attachment points being made to the supporting structure no less than 2 weeks prior to planned Construction Class IV work activities to allow time for the EOR/Qualified Engineer review. Any work delays occurring from the Purchaser's engineering review may result in delayed mobilizations and/or change order fees for downtime. Please note, if the Purchaser is unable or unwilling to attain the required engineering services to facilitate the construction review in accordance with current industry standards, any and all fees incurred by ERI for performing additional engineering assessments including any potential field inspections shall be submitted to the Purchaser as part of a change order.

3.2 The Proposal is based on work carried out in one mobilization and continuous operation without interruption or delays due to Buyer supplied missing materials, such as, but not limited to antennas, transmission lines, transmission line hangers, installation drawings, tower components, or electrical power. All material necessary for completing installation to be furnished by Buyer, must be on the tower site prior to starting of installation or scheduled in such a manner as to avoid delaying crew. Proposal is also based upon the following conditions:

3.2.1 Painting of the tower components (i.e. antenna or line) is not included in Proposal unless specified in Proposal.

3.2.2 Antenna feed line system will end just inside the transmitter facility (max 20'). Purchaser to have existing port for the line to enter. ERI is not responsible for installation inside the transmitter facility, such as, but not limited to inside transmission line runs, hangers, wall feed through plates, etc. ERI can perform these tasks at our standard daily rate if so desired.

3.2.3 This Proposal is subject to mutually negotiated scheduling and availability of resources and personnel. In case of significant delays beyond the control of ERI that cause ERI increased costs due to the rescheduling of crews, additional charges may apply. For this purpose, a delay shall not be considered significant unless it exceeds a period of ninety (90) days.

3.2.4 All work is to be performed unrestricted during daylight hours. (Weekend, holiday, or evening/ night work, when requested by customer will be billed an additional charge of 1.5 times standard rate.)

3.2.5 No guy wires interlaced or overhead power lines in working areas.

3.2.6 No tower, antenna, feed line, and/or bracket modifications required unless specified in Proposal.

3.2.7 No onsite transmission line field cuts required. If necessary, additional charges will be billed.

3.2.8 Antennas are assumed to have no more than 2 parasitic directors per bay. Each additional will be billed as necessary.

3.2.9 Taxes, bond or permit costs/fees have been paid by buyer/customer.

3.2.10 All antennas to be non-radiating or reduced to a safe power level while ERI personnel are in the immediate RF zones.

3.3 Downtime resulting from situations beyond the control of ERI or its subsidiary ERI Installations, Inc. as described above, will be billed at normal labor rates.

3.4 The Proposal on labor to install tower and/or antenna and other related equipment is based upon weather and time of day suitable for outdoor construction. Installation, field services and hazardous operations shall not be performed under adverse weather conditions for the safety of ERI personnel. Adverse weather delays shall be charged to Buyer at normal day rates and will be added to the construction schedule as time extensions. Certain operations may be performed under adverse weather conditions by mutual agreement and shall be billed at special rates provided in the Proposal. The ERI representative is the sole determinant of suitable and safe conditions while ERI personnel are on site.

3.5 In the event adverse weather causes a delay, ERI will notify the Buyer of those conditions and charges immediately. The responsibility for determine this condition rests with the ERI supervisor on site.

3.6 The tower site shall be accessible to workman and installation equipment, using two-wheel drive vehicles (under their own power) and heavy construction equipment such as, but not limited to cranes, concrete trucks, semi-tractor trailers, forklifts, etc.

3.7 All labor is based upon non-union wages. Should any conditions exist such that the use of union trades for installation of the tower, accessories and/or foundations is necessary, the prices stated in the Proposal are subject to adjustment unless a union stipulation has been specifically noted in the Proposal. Unless provided by ERI, the foundations must be completed so as to permit continuous work from time ERI's crew reports on the job and must be finished in accordance with ERI's specifications.

3.8 The Buyer assumes all liability resulting from site conditions differing from those specified or agreed to by the Buyer.

3.9 Unless otherwise specified in the Proposal, it is also Buyer's responsibility to:

3.9.1 To provide one (1) tagline path (75 feet wide and equal in length to the height of the tower) at the work face, cleared of all obstructions in order to permit a truck to be driven thereon.

3.9.2 Clear a guy path alley and fire lane down each guy radial 25 feet wide on each side of the guy line; and extend this lane 50 feet beyond the outer guy anchor, a 10-foot width of this 50-foot lane must be cleared of all obstructions in order to permit a truck to be driven thereon.

3.9.3 So grade the area immediately surrounding the tower site so as to permit the movement of trucks, cranes and/or other equipment required to handle and install the tower or related appurtenances.

3.9.4 Clear an area a minimum of 200 feet x 200 feet adjacent to the center of the tower to permit unloading, sorting, assembling, working space, and shall provide a hoist and equipment area 20 feet x 50 feet with capabilities for anchoring.

3.9.5 Provide a free and clear radius of 100 feet at the tower base for construction equipment and to allow staging and landing during tower construction and for future service work. This area shall have a rock/gravel surface bedding to support heavy equipment.

3.9.6 Provide fittings and gas required in pressure checking all of the antennas and transmission lines, if required.

3.9.7 A safe and secure work site to prevent theft and vandalism of contractor provided equipment and materials and Buyer delivered materials.

3.9.8 Provide electric power to the base of the tower suitable for powering construction equipment and tools. This also includes permanent electric power for the tower lighting system, if required, in accordance with the current revision of FAA circular AC 70/7460-1.

3.9.9 Provide the police service to direct traffic, if in the event the guy lines should cross a public or private road and secure the site from theft or vandalism of ERI equipment.

3.9.10 Provide toilet facilities, water, and trash containers for waste disposal. If sufficient trash receptacles are not provided, all trash and removed steel, antennas, mounts, lines, etc. shall be neatly left on site.

3.9.11 Provide scaled site survey of proposed tower location specifying tower location and orientation, property boundaries, site topography, overhead or buried utility service lines, or any other construction hazards or obstructions. Also provide survey required for antenna location and/or directional proof.

3.9.12 Provide a cleared and level area suitable for and capable of anchoring a hoist with a minimum area of 30' x 25'.

3.9.13 Obtain a tower structural analysis from a licensed Professional Engineer appropriate to the scope of work being requested.

3.9.14 Obtain any necessary rights of way and/or easements to allow access to work sites.

3.9.15 Provide a local certified electrical worker to make final connections. ERI's responsibility for lighting conduit and electrical wiring ends at the base of the tower.

3.9.16 Coordinate any required RF reductions or off-air time to allow ERI to perform necessary work in a safe and acceptable RF environment without any work flow interruption. If this cannot be accomplished, standby charges will apply at standard rates. ERI is NOT responsible for any consequential damages or loss of revenue or audience as a result of having to reduce transmitter power or go off air in order to accomplish a safe working environment.

3.9.17 Provide surveyed and staked locations for utilities, foundations, and directional proof prior to arrival of tower installation and/or foundation installation crews. Surveys must be coordinated with ERI.

3.10 When foundations are specified as a part of the Proposal, the Proposal for such work is based upon such work being undertaken and completed under "assumed normal" soil conditions as described by the latest revision of the ANSI/EIA-222 code. It shall be the responsibility of the Buyer to supply specific soil descriptive parameters, and ERI shall have an absolute right to rely on written test reports furnished by Buyer in the preparation of foundation drawings and in the installation of foundations. Normal soil conditions do not include rock, saturated soil, frozen soil, peat, or other soil variations similar or dissimilar. If subsurface soil conditions differ from geotechnical report and delay foundation work, the project schedule will be increased accordingly, and additional charges will be billed.

3.11 The installation price does not include work such as clearing or grading of tower site; installing, re-locating or repairing utility services; obtaining profiles or surveys; installing grounding systems unless specified; blasting; rock removal; water evacuation; cribbing; installing fill; removal of obstructions; snow removal, installation of planking; road building; clearance for site access; clearing of guy anchor paths; or any other kind of site preparation or site maintenance work.

3.12 If necessity dictates non-included labor or materials to be expended resulting from but not limited to, compliance to OSHA or local safety standards, inadequate site accessibility, non-included specified soil conditions, non-included labor or material requirements, then ERI shall be allowed to increase the installation and materials price to include any additional cost incurred, plus a reasonable profit.

3.13 ERI has the right to complete installation work early and be compensated for delay damages if other segments of the project, not in ERI control, affect an early completion of any part of ERI's work if ERI submits a reasonable plan to place the Buyer on notice of the intent to finish early and submits documentation of delays.

3.14 If requested or approved by the Buyer, ERI may provide accelerated services including overtime and/or multiple crews, as required to maintain the schedule or provide other services, and Buyer agrees to compensate ERI for such services.

Revised January 16, 2019